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THE SCHOOLS OF FORESTRY IN EUROPE.

A PLEA FOR THE CREATION OF A SCHOOL OF FORESTRY IN CONNECTION WITH THE ARBORETUM AT EDINBURGH.

BY

JOHN CROUMBIE BROWN, LL.D.,

Formerly Lecturer on Botany in University and King's College, Aberdeen; subsequently Colonial Botanist at Cape of Good Hope; and Professor of Botany in the South African College, Cape Town; Fellow of the Linnean Society; Fellow of the Royal Geographical Society; Honorary Vice-President of the African Institute of Paris.

Edinburgh:
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EDINBURGH ARBORETUM.

SCHOOL OF FORESTRY.

TO THE RIGHT HONOURABLE THE LORD PROVOST, THE MAGISTRATES, AND THE TOWN COUNCILLORS OF EDINBURGH;

TO THE OFFICE-BEARERS OF THE SCOTTISH ARBORICULTURAL SOCIETY;

TO THE PROMOTERS OF THE PURCHASE OF GROUND AT INVERLEITH TO BE TRANSFERRED TO GOVERNMENT FOR THE FORMATION OF AN ARBORETUM, AND ALL OTHERS WHOM IT MAY CONCERN;—

GENTLEMEN,—

Measures having been taken to secure the formation of an Arboretum in Edinburgh, I desire to bring under your consideration the importance of connecting with it arrangements for the study of what is known on the Continent as Forest Science.

One of the promoters of these measures, Sir Robert Christison, Professor of Materia Medica in the University of Edinburgh, is reported to have said, at a conference with a sub-committee of the Lord Provost's committee on the Improvement Act, held for the purpose of obtaining from him and Professor Balfour an explanation of the course proposed to be followed in laying out the ground at Inverleith, in the event of its being acquired by the Corporation as an Arboretum and public pleasure grounds, that he "had taken great interest in this matter from the time that the Arboretum was first mooted, regarding it as a much needed and valuable addition to the teaching power of the University. The science of Forestry, he

pointed out, was not taught in this country, and the consequence was that many young gentlemen had to proceed to the Continent in order to acquire that branch of education."

In Spain, in Italy, in Austria, in Poland, in Russia, in Finland, in Sweden, in France, and in every Kingdom and Principality in Germany, there have been established by Government Schools of Forest Science, or classes in connection with existing Universities, or Polytechnic Institutions, in which instruction is given in that science;* but nowhere in Britain, in the United States of America, or in any of the British Colonies, so far as is known to me, are similar facilities afforded for the study of this.

Dr Hooker, the Director of the Royal Gardens at Kew, writing on this subject, remarks: "Forestry, a subject so utterly neglected in this country that we are forced to send all candidates for forest appointments in India to France or Germany for instruction both in theory and practice, holds on the Continent an honourable, and even a distinguished place, among the branches of a liberal education. In the estimation of an average Briton, forests are of infinitely less importance than the game they shelter, and it is not long since the wanton destruction of a fine young tree was considered a venial offence compared with the snaring of a pheasant or rabbit. Wherever the English rule extends, with the single exception of India, the same apathy, or at least inaction prevails. In South Africa, according to the Colonial botanists' report, millions of acres have been made desert, and more are being made desert annually, through the destruction of the indigenous forests; in Demerara the useful timber trees have all been removed from accessible regions, and no care or thought is given to planting others; from Trinidad we have the same story; in New Zealand there is not now a good Kauri pine to be found near the coast, and I believe that the annals of almost every English colony would repeat the tale of wilful, wanton waste and improvidence. On the other hand, in France, Prussia, Switzer-

*Of Schools of Forestry, or Universities and Polytechnic Schools, in which provisionhas been made for the study of Forest Science, there have come under my notice at one time or another, such at all the places following, namely:—

Nancy, in France; Madrid, in Spain; Valombrosa, near Florence, in Italy; Neustadt-Eberswalde, Tharandt, Aschaffenburg, Karlsruhe, Hohenheim, Munden, Weiswasser, Braunsweig, Eisenach, Eulenberg, Hinterbruhl, and Giesson, in Germany; Mariabrunn, in Austria; Nova-Alexandra, in Poland; St Petersburg, Moscow, Lissino, Orenburg, Beliko-Anadolsk, Ostroff, Sokolsk, Lepetsk, Mittau, Viatchin, Gorka, Cazan, Charkoff, and Saratoff, in Russia; Tierps, Ombergs, Boeda, Hunneberg Danielsland, Silbre, and Stockholm, in Sweden. In regard to the course of instruction pursued in some of the more important of these, information will afterwards be given.

land, Austria, and Russia, the forests and waste lands are the subjects of devoted attention on the part of the Government, and colleges, provided with a complete staff of accomplished professors, train youths of good birth and education to the duties of state foresters. Nor, in the case of France, is this law confined to the mother country; the Algerian forests are worked with scrupulous solicitude, and the collections of vegetable produce from the French Colonies of New Caledonia, &c., in the permanent museum at Paris, contain specimens which abound in evidence of their forest products being all diligently explored."

Since my return to Europe, some ten years ago, from the Cape of Good Hope, where I held the appointments of Colonial Botanist and Professor of Botany in the South African College, I have, with the exception of a brief period, been in constant communication, personal and epistolary, with professors and students of Forest Science, and officials entrusted with the management or administration of forests in Britain, on the Continent of Europe, in the United States of America, in the British Colonies, and in India, having in the course of that time visited the United States a second time, and travelled extensively in France, Bavaria, Austria, Russia, Finland, Prussia, and Belgium, to obtain and to verify information otherwise obtained in regard to Forest Economy and Forest Science. And I submit for your consideration the opinion that, with the acquisition of this arboretum, and with the existing arrangements for study in the University of Edinburgh, and in the Watt Institution and School of Arts, there are required only facilities for the study of what is known on the Continent as Forest Science to enable these Institutions conjointly, or any one of them with the help of the others, to take a place amongst the most completely equipped Schools of Forestry in Europe, and to undertake the training of foresters for the discharge of such duties as are now required of them in India, in our Colonies, and at home.

I have before me the *Programme de l'enseignement à L'Ecole Forestiere*, at Nancy, and the official Report of the prescribed studies in the *Central-forstlehr-Anstalt*, at Aschaffenburg, and I am more or less acquainted generally with the courses of study followed at most of the other Schools of Forestry in Europe; and I consider that some such course of study as the following would be equivalent for the purposes of our countrymen to that followed in any one of these valuable institutions, with the advantage of not requiring the ac-

quisition of a foreign language, which few of our foresters and sons of foresters have facilities for effecting, or at least of effecting to such an extent as to enable them to understand instructions as thoroughly as they would instructions given in their own tongue :—

FIRST YEAR.

WINTER SESSION.—

Instruction to be given in the Structure and Physiology of Trees and Shrubs; in the Geographical Distribution of Forests; in the Treatment of Forests by *Sartage*, by *Jardinage*, by *à tire et aire*, by *les Compartements*, or the *Fachwerke Methode* of Germany; in the application of this to COPPICE WOOD, with a view to securing, along with other advantages, a sustained production of Wood; and in the application of it to TIMBER FORESTS, according as the object may be to secure from these a maximum size of timber, or a maximum produce of wood, or a maximum pecuniary return, along with Natural Reproduction, Sustained Production, and Progessive Improvement of the Woods; and in measures to be employed in the Conversion of Coppice Wood into Timber Forest, of Timber Forest into Coppice Wood, of Mixed Woods into either, and of either into Mixed Woods.

With attendance on the Classes in the University for the study of Natural History, under Sir Wyville Thomson, LL.D., with the assistance of Dr J. Balfour; of Mathematics, under Professor Kelland, M.A., with the assistance of Mr R. K. Galloway; of Engineering, under Professor Jenkin, with the assistance of Mr Wheatly;—or, with attendance on the Classes in the Watt Institution and School of Arts for the study of Mechanical Philosphy, under W. Lees, Esq., M.A.; and of Mathematics, under James Pryde, Esq., F.E.I.S.

SUMMER SESSION.—

Attendance on the Classes in the University for the study of Botany and Vegetable Histology, under Prof. Balfour, M.D., with the assistance of Dr Saddler; and of Practical Natural History, under Sir Wyville Thomson; and of Practical Engineering, under Professor Jenkin;—or, attendance on Classes, if open, in the Watt Institution for the study of Botany, under Dr M'Alpine; and of Mechanical and Geometrical Drawing, under Mr W. H. Wheatly.

AUTUMN MONTHS.—

Tours of observation, with or without the teacher, in Woods and Forests in Britain, in France, in Germany, or in the North of Europe.

SECOND YEAR.

WINTER MONTHS.—

Instruction in regard to the Forest Economy, Forest Legislation, and Forest Literature in Britain; in France and in Germany, countries in advance of all others in Forest Science, and in the practical application of it to the management of Forests; in Russia, where arrangements are being made to introduce and to carry out extensively the improved forest management practised in Germany and in France; in Finland, where arrangements have been made to manage the forests in accordance with the requirements of Forest Science; in Sweden, where the latest arrangements suggested by Forest Science are being carried out with vigour; in British Colonies; in America; and in India, where have been introduced many of the suggestions of modern Forest Science, and the forest economy practised on the Continent of Europe.

With attendance at the Classes in the University for the study of Theoretic Chemistry and Practical Chemistry, under Professor A. Crum Brown, M.D., with the assistance of Dr Letts, &c.; and Natural Philosophy, and practical application of the same, under Professor Tait, M.A., D.Sc., with the assistance of Mr Lang;—or, with attendance at the Classes in the Watt Institution and School of Arts for the study of Chemistry and Practical Chemistry, under Dr Stevenson Macadam, F.R.S.E.,; of Engineering, under Mr Wheatly; and of Geology, under Dr M'Alpine.

SUMMER AND AUTUMN MONTHS.—

Practical experience in the management of Woods, or in the management of Nurseries, to be acquired under the direction of approved foresters, or approved nurserymen.

THIRD YEAR.

WINTER SESSION ONLY.—

Instruction in the Chemistry of Vegetation and of Soils; in the Meteorological Effects of Forests on Moisture, on Temperature,

and on Constituents of the Atmosphere; in Sylviculture, as applied in Belgium, &c., to utilise waste lands,—in the Landes of France, to arrest and utilise drift sands,—in the Alps, the Cévennes, and the Pyrenees, to prevent the disastrous effects and consequences of torrents,—on the Karst, in Illyria, to restore fertility to a land rendered sterile by the destruction of trees,—in the United States of America, to prevent anticipated evils,—in India, to secure desiderated good,—in Britain, to increase amenity, covert, and shelter; and instruction in the injurious effects of Cattle, Insects, and various diseases on Trees.

With attendance on the Classes in the University for the study of Geology, under Professor Geikie, LL.D.; of Agriculture, under Professor Wilson; and, if it be desired, any of the following: for the study of Political Economy, under Professor Hodgson, LL.D.; of Conveyancing, under Professor Stuart Tytler, LL.D.; or of Bandaging and Surgical Appliances, under Professor Spence;—or, with attendance on the Classes in the Watt Institution for the study of Animal Physiology, of German, or of French.

In the curriculum which I have sketched, I have had regard to all that is required in Continental Forest Schools, and only to what is required, in some, if not in all, of these institutions, in the study of what is included under the designation of Forest Science. I have also had regard only to the teaching power of the University of Edinburgh, and of the Watt Institution and School of Arts, through existing provision for the teaching of the classes specified.

In many of the institutions referred to, the provision for practical training in woods and forests is much more ample than is at present at command in Britain; but there is a corresponding reduction in the time allotted to the curriculum; and this is so arranged that it may be entered upon at the commencement of any one of the sessions.

It is contemplated that the studies should be conducted by the use of text-books, by lectures, by oral examinations at which the students should be encouraged to ask questions of the teacher, by written exercises of various kinds, and by formal discussions by the students under the presidency of the teacher.

And it is contemplated that the class should meet for an hour five days a week, at a time which would not interfere with the classes attended at the University, or in the Watt Institution and School of

Arts, or with daily work in the nurseries, gardens, or woods in Edinburgh and its vicinity.

Not knowing of the desire of Sir Robert Christison to provide facilities for the study of Forestry in connection with the University and the Arboretum, I have, for some weeks past, been endeavouring to meet this felt want; and in doing so, I have come to know that the desideratum has been felt by many others, including Governers of Colonies, noblemen and gentlemen in Britain, the agents of landed proprietors, foresters and nurserymen, and men distinguished for their attainments in science and their endeavours to employ these in the advancement of the interests of man, as will afterwards be shown.

It may be asked, where are the money and the men required for the execution of such a scheme of study as I have submitted to be found?

At the conference of the sub-committee of the Lord Provost's committee on the Improvement Act with Sir Robert Christison and Dr Balfour, already referred to, Sir Robert Christison is reported in the *Scotsman* to have said:—"His views on the subject were practically those of Professor Balfour and the Professor's able coadjutor (Mr Macnab). The latter gentleman had prepared a sketch of what was contemplated in the way of laying out the ground, but as the plan was of a very general nature, no definite steps had been taken in the matter; and, moreover, he need hardly say it rested very much with the Government to decide as to the details of the scheme. Professor Balfour then explained that it was not proposed that there should be a forest of trees formed—as was generally understood—but that there should be clumps of trees planted here and there, showing the various stages of development, that about nine-tenths of the ground would be green sward, that broad walks would be provided for people promenading, and that the ground remaining would be available to the public."

In the report of the subsequent proceedings of the Town Council in the matter, which appeared in the same journal, it is stated:—"The Lord Provost's committee submitted a draft agreement which had been entered into between the Corporation, Her Majesty's Board of Works, and Mr F. Pitman, W.S., as representing the trustees of the late Sir William Fettes, and on behalf of Mr C. H. Rocheid of Inverleith, in connection with the acquisition of the lands of Inverleith, including Inverleith House, under the Edinburgh Improvement Act,

1876, for the formation of an arboretum, public park, and pleasure ground. "From this and other documents it appeared that the price to be paid by the Town Council for the ground, which is about 30 acres in extent, is £18,406, with interest at 5 per cent. from Whitsunday until payment be made. The Government is to take over the ground, releasing the Corporation from all obligations connected with it, and to lay it out. The estimated cost to them of doing so—including two sums of £3000 and £1926, which they are to pay as the redemption price of certain feu-duties—will be about £16,000. The arboretum is to be placed under the Parks Regulations Act, 1872, and to be maintained in all time coming by Government. . . . The committee recommended the Council to approve of the agreement, which had already been sanctioned by Her Majesty's Treasury and the Board of Works, and to authorise the Lord Provost and Town Clerk to sign the same; further, that the subject be recommitted, with powers, to the Lord Provost's committee to complete the transaction, and to take steps to obtain, by way of loan from the Public Works Loan Commissioners, or otherwise, such sum or sums as may be necessary for this purpose.

"The Lord Provost moved the adoption of the report, which was seconded by Bailie Methven, . . . and allowed to pass."

The laying out of such grounds can be executed only by a professional forester. But thereafter it may be open to question whether the curatorship of them should be entrusted to a practical or to a scientific officer, and if the latter should be resolved on there is provision made for the experiment of introducing the study of forest science at little additional expense.

I presume if this were done, and if it were extensively made known that this was the case: that there was an arboretum, about 30 acres in extent, adjoining the Botanic Gardens and Experimental Gardens, in extent some 20 acres more, with a view described "as one of the most magnificent views of Edinburgh which could be obtained," and "as one of the finest in Europe, including as it did the northern portion of the city, with its spires and domes, and the outstanding eminences of the Castle, Calton Hill, Salisbury Crags, and Arthur's Seat," and that related studies could be carried on under such men as Sir Wyville Thomson, and Professors Balfour, Kelland, Tait, Jenkin, Wilson, Geikie, Hodgson, Stuart Tytler, and Alexander Crum Brown, with such assistants they have, and such men as are gathered around Dr Stevenson Macadam and Mr Lees in the Watt Institution, there will be no lack of candidates for the work.

I consider that there must be many of the officers of the Forest Service in India well-fitted, by previous training and experience, for conducting such a course of study as I have proposed. Failing this, there might be found, by correspondence with students of forestry on the Continent, able men who might be willing to master the English language and give lectures on some or all of the subjects I have ennumerated.

I have, for some years, myself been engaged in the compilation of information on subjects connected with Economic Botany, with a view to this being, if not previously printed, or otherwise used, deposited in manuscript in the Public Library, Cape Town, Cape of Good Hope, for consultation by scientific and practical men seeking to develope the vegetable resources and the agricultural capablities of that Colony; and I have ready, compiled and translated, all the material requisite for such courses of lectures on Forest Science as I have spoken of. If other duties permitted, I should esteem it an honour, as any man might do, to be entrusted with an opportunity of testing the practicability of establishing a British School of Forestry in connection with the proposed Arboretum; and from this I conclude, that no difficulty need be anticipated in procuring teachers, if only the necessary arrangements for the teaching were made. And under this impression I would bring under your notice, and submit for your consideration, detailed information in regard to what has been done elsewhere.

The first systematic teacher of forest science and forest economy appears to have been Zanthiere, who did so at Ilsenburg, a town or village in the county Stolberg, in Upper Saxony, situated not far from the Hartz Mountains, and within the precincts of the old Thuringian Forest. Prussia was not long in perceiving the advantages likely to result from forest officials getting an education and training specially adapted to prepare them for the duties to which they might be called in the management of the forests, and a Forest School was established at Neustadt-Eberswalde, some thirty miles north from Berlin.

Neustadt is one of the manufacturing towns of Prussia. It is situated on the Finow, a stream which is here connected by a canal with the Oder on one side and the Havel on the other, and on the railway from Berlin to Stettin.

The Academy of Forestry is devoted to the training of Government forest officers, and of managers of forests belonging to private pro-

prietors; it is confined exclusively to this, and no person can obtain an appointment to an office in the forest department of the Government without having undergone a strict examination in the several branches of knowledge required in the proper administration of forests, and without having served personally in the forests for a considerable length of time.

Capt. Campbell Walker, formerly Deputy-Conservator of Forests at Madras, now Chief-Conservator of Forests in New Zealand, writes of a visit paid by him to Neustadt-Eberswalde :—

"I visited the Forest Academy at Neustadt-Eberswalde, and had a most interesting conversation with the director, Herr Ober-forstmeister Danckelmann, on various subjects connected with forestry in Europe and India. He is assisted by a staff of seven professors, with assistants, and there is an experimental garden attached to the academy, with Oberforster Bernhard in charge of the strictly technical portion, and other gentlemen for the meteorological, zoological, and chemical sections. The number of students at the academy averages 65. Oberfoster Bernhardt kindly accompanied me round the gardens, and pointed out everything of interest, including a building where the seed is dried and separated from the cones, known as a "*Sammendarre*," extensive seed beds of spruce and fir sown in parallel lines with the help of boards specially adapted for the purpose, which insure regularity, and the seed being all at the same depth; seed beds of willow, and treatment of the seedlings when transplanted; and examples of trees of every description for botanical study, including many of the rarer descriptions for the more advanced students.

"Professor Dr Altum, the successor of the well-known entomologist Ratzeburg, author of a large work on insects destructive to trees and timber, accompanied me through the museum, which is rich in specimens of all sorts of birds, animals, and insects found in the forests, very neatly arranged in cases. Where the animal or insect does damage to trees, specimens of the branch, bark, leaf, root, or cone, in a healthy state, and after being attacked, are exhibited close to each, so that the student can see at a glance the nature of the damage, and connect it with the animal which causes it. Thus we have squirrels, rats, beavers, mice, set up to represent nature, gnawing the barks, grubbing at the roots, &c., &c. Insects are shown in the several stages of their existence, larvæ, chrysalis, caterpillar, moth, with their ramifications in the stem or branches of the tree. These, with specimen blocks of almost all descriptions of

timber, form a most instructive and interesting collection, in which much time could be spent with advantage.

"Nothing struck me as more remarkable than the extent and varied nature of the studies required from forest candidates or probationers in Prussia, and the number of years they are content to spend, first in studying, and then in waiting for an appointment. The would-be Oberforster, which is the lowest of what we would call the 'gazetted appointments,' must, after passing certain terms at a Government school of the first class, spend a year with an Oberforster in a revier, and then pass an examination as forest pupil, after which there is a two years' course at a forest academy, and an examination in scientific forestry, land surveying, &c., on passing which the pupil becomes a *'Forstkandidat;'* then another two years practical study, during at least nine months of which he must actually perform the duties of a forester, after which comes the final Government examination, on passing which he enters the grade of Oberforster-kandidat. The difference betwixt the two examinations is explained to be that the first tests the candidate's knowledge of theoretical forestry and cognate sciences, whilst the latter tests his ability to apply what he has learnt, and capability for employment as Oberforster and in the higher grades.

"After passing the final examination, the Oberforster-kandidat is employed as an assistant in the academies and control offices, in making forest surveys and working plans, and sometimes acting in charge of a revier, receiving certain daily or weekly allowances whilst so employed. After five or six years of this probation, he may look forward to being permanently appointed.

"Thus we have at least five years spent in study, and another five in probation; the former without any pay, and the latter only with meagre allowances whilst actually employed, before the would-be forest officer is installed; and the time is generally much longer. Yet so great is the desire for Government service, and particularly forest service, in Prussia, and indeed in Germany generally, that there is no lack of competitors."

According to one of my correspondents, a few years ago there were no fewer than thirty-three Barons or Baronets held appointments in the Crown Forests of Prussia.

The Forest School of Saxony is at Tharandt, a watering place a few miles distant from Dresden, beautifully situated at the junction of three valleys, from two of which flow streams which unite and flow

through the Planschengrund into the Elbe. "The neighbourhood abounds with pretty romantic walks. From the ruins of the old castle, the remains of a hunting seat of the ancestors of the Royal Family of Saxony, which may be reached in ten minutes from the inn, you look down from a promontory of rock on which it is perched into a deep and picturesque valley on either side.

"The forest garden is a nursery forest, containing, it is said, 1000 different species of trees and shrubs, attached to the Forest School. From this a fine view may be obtained, and there are fine walks in it. The same may be said of the Heilige Hall, an avenue of beech trees."

This Forest School was founded by Cotta, whose name, with that of Harting, is identified with what is known in Germany as the *Fachwerke Methode* of forest management, and in France as the *Methode des Compartements*, which is the most advanced, in its accordance with forest science, of the various methods of exploitation applied to coppice woods and timber forests.

Cotta held the combined employment of Chief of the *Institute d'Amenagements*, entrusted with the management of the Crown Forests of Saxony, and of Director of the School of Forestry, which was founded by him in 1810. The Institute consisted of a number of commissioners who in summer carried on operations in the different forests, under instruction from him as their chief; and in winter, re-assembled at his residence, there to conduct under his direction the work of Forest-Bureau and prepare plans of operation for the summer following. Combined with the School of Forestry is an Agricultural College.

In Hanover there is an organised Forest Service consisting of 1 forest director—20 forest masters, who each have charge of a division and together with the forest director form a board of management—112 chief foresters—403 foresters—and 343 overseers and under-foresters, who watch and protect the forests, and supervise work done by hire or contract; and, to provide for this service, Forest Academies, at which the officials are educated and trained; one of these I am told is at Munden, situated at the confluence of the Werra and the Fulda, whose united waters here take the name of Weser.

The Forest School of Hesse-Darmstadt is at Giesson, the chief town of Upper Hesse, beautifully situated on the Lahire, and is

attached to the University, well-known to students of agricultural chemistry as that in which Liebig laboured so long and so successively as Professor of Chemistry.

The Forest School of the Grand Duchy of Baden is at Karlsruhe, where it is combined with a College of Engineers, and a Polytechnic Institution.

In Wirtemburg there are employed in the administration of the forests—1 Director, who has the principal oversight and control of the administration of management of forests throughout the kingdom; his salary is £280. 5 Forest Councillors, who are assessors of the director, and with him have the oversight and control of the whole; their salaries range from £180 to £230. 23 Forest Masters, under the Forest Collegians; their salaries range from £150 to £170 Under each of these there are from four to seven District Foresters, who, under his direction, attend to practical operations in the forest, attending to the felling of wood, the culture of the trees, and the resowing or planting of cleared forest lands. 125 Revier Foresters; with salaries ranging from £90 to £120. 154 in all.

The Wirtemburg Forest Academy is combined with an agricultural college at Hohenheim, not far from Tubingen.

In Bavaria, in 1861, the staff of forest officials consisted of 2 Ministerial Councillors, 11 Forest Councillors, 1 Director of the Forest School at Asschaffenburg, 4 Professors, 1 Lecturer, 17 Circuit Forest Masters, 81 Forest Masters, 609 Revier Foresters, 175 Forest Actuaries, 643 Forest Warders, 631 Forest Assistants, 315 Forest Watchers—in all, 906 connected with forest management, 1589 connected with forest protection—together, 2495; and for such a service there is a School of Forestry of proportionate importance.

The Forest School of Bavaria, which enjoys a well-merited celebrity, is at Asschaffensburg, between Frankfort and Wurtzburg. Preparatory to entering this, students must have passed through the gymnasium satisfactorily, and must, with the sanction of Government, have passed through a preliminary instruction of eight months, extending from September to May, under a revier, or district forester approved and appointed by Government. They must not be above 23 years of age, and they must possess means of support throughout the period required for attendance at the forest school.

The instruction given in the school embraces—(1) Forest Science, or theory of forest administration in all that relates thereto; the

physiology of arboreous and arborescent vegetation; forest culture; forest economy and technology, including road-making, bridge-making, and house-building, the preparation of charcoal, potash, turpentine, tar, and lamp-black; the theory underlying forest conservation and forest management in the practical regulations of operations throughout an extensive district.

(2) Physical science, more especially, general and economic botany, the latter having special regard to plants of importance to the well-being of the forest and the interests of the country, with practical instruction in gardening; mineralogy, including geognosy and geology, with the use of the blow-pipe; zoology, in regard to the natural history of animals interesting to the forester, the huntsman, and the agriculturist, more especially that of noxious insects and of game; and finally, natural philosophy, including organic, inorganic, and analytic chemistry in their application to forests and agricultural operations, with experimental analysis of soil, of ashes, of plants, of water, of air, and of manures.

(3) Mathematics, including algebra, plane geometry, cubic mensuration, trigonometry, statics, dynamics, optics; mensuration, with practical application; instruction in preparation of charts, in taking levels, and in estimating the condition and value of forests.

(4) The theory of state management of forests, forest police, forest legislation, forest administration, and practical management of forests.

(5) Agriculture, with a special reference to soils, culture, manure, meadow culture, grain culture, and the theory of administration.

(6) More comprehensive theory of game; principles and rules for the management of game, reviern with deer, boar parks, and pheasantries for the utilisation of game,—for the hunting or taking of game; and of the game laws.

Instruction is given by encyclopædic lectures, with illustrations of the practical application of theoretic statement in excursions, conducted by the professors, in forests near and distant; and necessary assistance toward meeting the expenses of such excursions is given to the poorer students.

The year of study begins fourteen days after Easter, and extends over $2\frac{1}{2}$ years. In addition to this, those who aspire to the higher forest appointments—*e.g.*, those of forest master and upwards—after finishing their course at the Forest School, are required to prosecute the study of science at one or other of the State Universities at Munich or Wurtzburg; and after this, as at the conclusion of their

course at Aschaffenburg, to undergo an examination on the required subjects of study.

Promotion to a higher appointment in the Forest Service is also dependent on a strict examination, and not more than one opportunity of passing is allowed.

Non-professional students and foreigners may join the Forest School, but only on condition that they possess the necessary qualifications for understanding the instructions given, and that they give a written declaration that it is not their intention to enter the Bavarian Forest Service.

For Bavarian subjects the fee is 12½ florins (25s.) and for foreigners 25 fls. (50s.) per half-year. Besides this, every candidate has to pay a matriculation fee of 4 fls. (8s.), and a similar fee for certificate at the close.

Candidates are subject to a rule of discipline, and are bound to a prescribed college course. Foreigners may obtain from the director a dispensation from particular studies. There is a valuable museum of objects of Natural History connected with the Institution open to the students. For the sons of Government officials, and more especially of those who are in the Forest Service, who are without the means of meeting the expenses, there are provided five scholarships of 250 fls. (£25), ten of 200 fls. (£20), and ten of 150 fls. (£15), and also five scholarships of 250 fls. (£25) for forest candidates of limited means who go to the Universities named to prosecute their studies.

The College staff consists of a Director, who, together with the first professor of Forest Science, has the rank of a Government and Circuit Forest Councillor, and four other professors with the rank of forest masters, and a revier forester, who acts as lecturer and as actuary clerk.

The direction and the control of the School is vested in the Minister of Finance and the Church and School Department of the Bureau of the Minister of the Interior, and in subordination to them in the Director of the School.

To the Director pertains the maintenance of order, the superintendence of the course of study and instruction, the granting of certificates, and every thing connected with the management of the institution which has not been specially and expressly committed to the director and professors conjointly.

Students on finishing the curriculum at Asschaffenburg either enter on further practical training in the forest or in a forest office, or on attendance at a course of lectures on State Economics at the

University; and they afterwards receive appointments to Government employment in the order of the excellence of the testimonials they have obtained.

In general the practitioner is not allowed, without forfeiture of all title to Government employment, to leave the service till he has attained the first or lowest grade of a Government official; but in special cases exemption from conformity to this requirement may be granted by the Government of the Kreis, Circuit, or District.

In Austria there are numerous schools, academies, and colleges established for supplying instruction and training in all that relates theoretically and practically to the development of the agriculture and horticulture of the country, and of manufactures connected with these; and with these there are three grades of Schools of Forestry, *Niedere Forst Schulen*, or Primary Forest Schools; *Mittlere Forst Schulen*, or Middle Class Forest Schools; and the *Forst Hoch School*, or High School of Forestry.

The *Forst Hoch Schule* is known as the K. K. *Forst-akademie*. It is in Mariabrunn, in Lower Austria. It was founded as a *Forst-lehranstalt*, in 1813, and re-organised in 1867; and since 1872 it has been continued as a superior school of forestry. There is a staff of 8 professors and 6 assistants. The curriculum of study extends over 3 years. The number of students in 1871-72 was 38; in 1872-73, 34.

One of the Middle Class Forest Schools is the *Mährische-Schlesische Forst Schule*, in Eulenberg, by Sternberg, in Moravia. It was established in 1852. There is 1 teacher. In 1871-72 there were 43 pupils. In 1872-73, 42. The curriculum of study extends over 2 years.

The other is the *Böhmische Forst-lehranstalt*, located at Weisswasser, in Bohemia It was established in 1855. There are 5 professors. In 1871-72 there were 39 pupils; in 1872-73, 36. The average number is about 40. The course of study embraces 2 years.

Of the Primary Forest Schools one is the *Niederœsterreichische Waldbau Schule*, in the Hinterbruehl, by Mödling, in Lower Austria. It was established in 1865. There are 2 teachers. The course of study is comprised in 1 year. The average and usual number of students is 8.

The other is the *Krainerische Landes Waldbau Schule*, in Schneeberg. It was established in 1869. There are 2 teachers. In

1871-72 there were 10 pupils; in 1872-73, 8. The course of study embraces 2 years.

In 1858 Baron von Berg, Ober-forst-rath in Saxony, was applied to professionally to examine and report on the state of the forests, and the forest management in Finland; and he was thereafter applied to do the same in Poland. In this country, Poland, at Nova Alexandria, there has been established an important School of Agriculture, ranking with the universities of the empire. It was founded with a view to prepare agriculturists and foresters for carrying on their respective operations in accordance with the discoveries of modern science. There are two divisions, one relating to agriculture, the other to forest economy. The course of study extends over three years. Students must have passed through a gymnasium, or some corresponding public school. The fee charged is 50 roubles per annum. And they obtain, after passing satisfactorily the required examination at the close of the course, a diploma, giving them rank as agriculturists or as foresters.

There is an experimental farm attached to the Institution.

From Poland we naturally pass into Russia.

In the *Ustaff Laesnoi*, or Forest Code of Russia, I found numerous details given of provision for the instruction of all employed in the management of the Crown forests.

In a report by M. Wereka, issued by the Ministry of the Imperial domains, it is stated, that for the training of young men for carrying out forest operations in the service of the Government, or of private proprietors, there exist two special schools for superior instruction: The Agricultural and Forest Institute at St Petersburg, and the Agricultural and Forest Academy of Petrowski, at Moscow. In these two establishments the course of studies extends over three or four years; and the students, having completed the course, leave with the rank of Practical Student or Candidate. For the training of the students in the practice of forestry, there are adjoining the academy of Petrowski two forests, one of 267 hectares and another of 73 hectares. Students at the Institute at St Petersburg exercise themselves in practical work in the forest of Lissino, distant about 70 versts from St Petersburg, and containing 30,000 hectares of forest, or 75,000 acres.

Besides these two establishments, there is also in the Government of St Petersburg, at the village of Lissino, adjoining the forest, a forest school of the second class, at which the course of study extends

over three years, when those who have completed the course leave with the rank of Forest Conductors, and may receive appointments as forest assistants and as forest officers of the fourth class.

I visited the agricultural and forest institute at Lanskoy, in the neighbourhood of St Petersburg, and had every assistance in my inquiries afforded by the resident forest inspector, and the professors of botany and forest economy.

On the grounds of the Lanskoy institution, but at a considerable distance from the forest school, is the agricultural college.

There are in all a staff of 15 professors. There are two divisions: that of agriculture, and that of forest science. In the latter there were 150 students.

Such are admitted after completing their seventeenth year, and having passed through a gymnasium, or any similar middle class school or college. The course of study extends over three years, and, upon an average, forty complete their course annually.

The fee is 25 roubles per annum. The lodgings vary in size; but the space between every two is windows the same, and each window is supposed to mark out the space sufficient for each student, and the charge is made accordingly: 30 roubles for one window, including fire-wood and service.

The text-books on forest economy used in the forest school at Lanskoy were *Der Wald*, by C. A. Rosselmaessler; *Der Wald*, by Coatz; *Fur Baum und Wald*, by Schleiden. Of these the first only had been translated into Russ. And this translation was used; it is entitled *Laetz Rosselmessler*.

The wooded grounds around the Institute are extensive and beautifully laid out. This was done, I was informed, by the students; and annually months are spent by them in carrying on practical operations in the larger forest attached to the school of the second class at Lissino.

The Forest School at Lissino is designed for the training of young men for the discharge of the duties of the inferior classes of forest officers, and for the training of foresters to be employed by private proprietors. Pupils are received from 15 to 20 years of age.

Boarders pay 120 roubles per annum. Those who are educated at the expense of Government are required to enter the service of Government for a period of six years. On the completion of their course, they enter the service as *Conducteurs*.

This Institute has experienced many changes. Of the articles of the Forest Code, Nos. 383–522, all relate to these. It may be

stated generally that in 1867 it was announced that an order had been issued extending the course of study from a term of two years to a term of three years.

In 1868 it was announced that the number of students supported and educated at the expense of Government had been limited to 90; but students whose expenses were met by themselves, or by others, might be admitted in any numbers for whom accommodation could be found.

And in 1862 was given a code of rules which had been laid down for the examination of candidates, in accordance with which:—(1) all pupils, whether supported by Government or otherwise, may be admitted to examination if above 18 years of age.

(2) Those who are not Government students are required to produce documentary evidence that their parents or curators consent to their entering the Government Forest Service.

(3) The examination is to be conducted in accordance with the general regulations laid down for the examination of such candidates in other similar institutions in the empire.

(4) After passing satisfactorily this examination the candidate remains in the school three months longer for practical training, along with their former fellow-students.

(5) During this period of training they receive from the Government free lodging, but they must meet the expense of their own maintenance.

(6) At the expiry of this period of practical training they receive the designation of Forest Conductor if they have conducted themselves satisfactorily, have manifested the taste required for the service, and have been approved by the examining officers as fit men for the service; but not otherwise; and with the designation Forest Conductor they become entitled to all the rights and privileges of Conductors who have completed their course of education in an Imperial school.

The Agricultural and Forest Academy at Petrowki, near Moscow, was established on its present basis some years ago. On the 1st of June, 1872, there were 333 students in attendance. Amongst students who had completed their studies there, within the brief period of its existence, 16 had taken the degree of *Candidat*, which, I was told, was considered to correspond to the university degrees of Master of Arts, and of Doctor of Philosophy; of these 3 were students of agriculture, 13 students of forest economy.

Provision is made for the board and lodging of students, but it is

not requisite that they should avail themselves of these. They must be 21 years of age, or have gone through the course of study pursued in a gymnasium, or other public school of corresponding rank. Amateur students may be admitted to any of the classes, but regular students must go through the whole course. The fee charged here is 25 roubles per annum. The fee charged to those who take only one or more of the classes is 5 roubles for each. For lodgings in the institution the charge is 4 roubles per month ; for dinner of two dishes, 6 roubles, for a dinner of one dish, 3 roubles are charged. The rouble may be reckoned as half-a-crown.

The Director has power to dismiss any student for satifactory reasons. The income, derived partly from Government grants and partly from fees, was, in 1871, 161,218 roubles; the expenditure, 135,237.

Besides these three principal Schools of Forestry and of Agriculture, and others in Moscow, in the Government of Viatcha, in the Government of Mogelhoff, at Gorka, at Cazan, at Cherkoff, and at Saratoff, where young men are trained to act as agriculturists and as managers of estates—there are minor Forest Schools in different parts of Russia, in which in some cases special attention is given to what may be considered special requirements of the districts in which they are situated. Such are the following—(1) the Orenburg Forest school, designed for the training in forest management of 12 youths from 14 to 16 years of age connected with the Orenburg Cossacks, and a similar number from other regiments in the Oural districts, by practical work in the forests in the spring, summer, and autumn, and by instruction during the winter in arithmetic, geometry, land-surveying, and the geography and history of Russia.

(2) The Mittau Gymnasium, into which have been introduced classes for instruction in Forest laws, and in Forest management.

(3) The Huntsman School at Ostroff, near Moscow, in which provision is made for the admission of sixty youths to be trained for superior appointments, and to which boys of superior intelligence may be sent from the Foundling Hospital.

(4) A similar school at Sokolsk in the Government of Grodno.

In the list of changes, made previous to April, 1863, there is added to these a Steppe Forest School at Beliko-Anadolsk, and a Huntsman school at Leepetsk.

For both of these are laid down numerous rules and regulations classified and arranged.

In regard to the latter it is stated, along with many other things,

that candidates for admission may be sent by any community, if these can testify to their good moral and intellectual qualifications, and recommend them for the work. A special allowance for the support of the school is to be made annually from the Imperial Treasury. The students after leaving the school are required to enter the service of Government for a period of ten years, if drawn from the class of nobles, or from the Foundling Hospital, or for a period of twelve years, if drawn from other communities, the service to be reckoned from the day they pass their examination. In no case are they allowed to enter the service under sixteen years of age, and only in case of sickness or some similar urgent cause are they allowed to leave before the expiry of their period of service.

On the establishment of this school, the huntsmen's school at Ostroff was given up, and pupils were removed to Leepetsk.

In regard to the Steppe Forest School at Beliko-Anadolsk, it is stated, amongst many other things, that the students are to give their attention to the planting of the steppes with trees; the acclimatisation of several kinds of trees which are named; scientific meteorological observations, with the bearing of the facts observed upon the climatal conditions of life; observations on the growth of trees under certain conditions of climate; and on the effect of the growth of trees on the steppe on the climate of the locality.

The Central Forest Department is to provide them with forest seeds; and from certain institutions, subject to the Ministry of Imperial domains, charged with the culture and collection of seeds, they are also to receive seeds free of charge.

At the National Exhibition held in Moscow in celebration of the 200th anniversary of the birth of Peter the Great, there were exhibited many forest products—amongst others, these: Sections of trees of various ages, some of very great age; seeds, with information as to where they were to be obtained for planting, and directions in regard to the treatment required by seeds and seedlings, and an exhibition of the method adopted in drying the seeds; implements used in forest operations, and models of machines, and large tabulated reports, from which much could be learned at a glance in regard to the state of forest economy throughout the empire.

In the official residence of the Minister Imperial domains is the Museum of the Forest Society.

After the close of the Imperial Exhibition at Moscow, in 1872, the greater part of the collection of objects exhibited by the Forest Department were transferred to St Petersburg and became the germ

of this museum, created by the Forest Society. It contains a large and valuable collection, of maps, plans, drawings, and tables connected with the present state of the forests in Russia, and with these, several other more or less interesting collections of objects connected with different departments of forestry. Admittance is free at all times, on application to the Chancellor of the Society.

There is an Agricultural Museum on the Isaacks Plain open to the public, free on Monday, Wednesday, and Thursday, and on other days on payment of a small charge. On Monday and Wednesday an official goes over the whole giving explanations; and on Thursday, at one o'clock, the machinery is exhibited in motion, and arrangements are made for taking in orders for almost everything connected with the department which it may be desired to purchase.

A museum somewhat similar in character to those described is to be found, near the Summer Garden, which is open, I believe, every day, excepting Monday, from ten A.M. to three P.M., and on Tuesday also from six to nine P.M.

I have had occasion to mention, that in 1858 Baron von Berg, Ober-forst-rath in Saxony, was applied to professionally to examine and report on the state of the forests and the forest management of Finland. He did so; and amongst other results was this:—

For the instruction of candidates for employment in the forest service, there was established by decree, dated 10th March, 1859, a forest school at the Crown Park of Evois, in Lampes-socken, in Tavastehus-län, in which they might be thoroughly instructed in all that relates to the theory and practice of forest economy. It was opened on the 15th April in the same year, fully organised, and placed under the superintendence and charge of a director, with three resident lecturers and one field instructor. Students desirous of enjoying the benefit of the institution were required to produce a university diploma, or a first-class certificate of the completion of the course of study at one or other of the civil gymnasiums of the country; and there was provided for them free instruction, with free quarters and fire-wood.

The establishment, after a time, was closed from lack of students; but it seems to have been subsequently re-opened, and, with it, another at Mustiali.

The following salaries were allotted to the officers employed in the forest administration: That of the over-director, 8,600 marks; of the engineer, 5,200 marks; of the secretary, 3,600 marks; of the chan-

cellor or treasurer, 3,600 marks; of the forest master, 2,000 marks. To officials in the active service of forest management there was allowed, with table money and travelling allowance, to over-forest-masters, from 4,000 to 4,400 marks; to forest masters, 2,800, together with house; to forest warders, with hut and ground, from two to five barrels of corn, and from 20 to 100 marks in money.

The salary of the Director of the Forest Institute at Evois, with free house, was 6,080 marks; of lecturer, 3,400 marks; of field instructor, 1,600 marks. The mark is in value 10½d sterling.

In Sweden there was established, in 1828, a Forest Institute; and in 1860 it was decided to establish, also at the expense of the Government, Lower Forest Schools in different parts of the country, so as to provide in the former a higher course of instruction for the education of forest managers, and in the latter a more restricted course for the education of skilled foresters and planters.

The regulations were issued by the King, under date of May 25th, 1860. The following is substantially a translation of these furnished to the Secretary of State at Washington by the Honourable C. C. Andrews, Minister Resident of the United States to Sweden and Norway, but this somewhat modified or changed :—

"CHAPTER I.—THE FOREST INSTITUTE—ITS OBJECT AND ORGANISATION.

"§ 1. A suitable mansion in the royal park, near Stockholm, shall continue to be placed at the disposal of the Forest Institute, containing lecture-rooms, library, rooms for collections, for the director, for a teacher and for a porter, also necessary ground for nursery, tree-planting, and target-ground; a suitable forest in the vicinity of the city shall also be placed under the regular care and management of the institute, in order to secure to the pupils practical knowledge required.

"§ 2. In order to teach the pupils surveying, appraisement, and the technical terms of the forest, they shall, during a certain time every year, be employed in forests suitable for this purpose, under the direction of the teachers; separate funds will be assigned for this purpose.

"§ 3. To assist the pupils during their stay at the institute, a certain number of stipends, the amount of which will be separately fixed, shall be assigned to such indigent pupils as have made themselves deserving of the same, through industry, skill, and good conduct.

"§ 4. The institute is to be managed by a director, appointed by His Royal Majesty, and the director, together with four teachers, also appointed by His Royal Majesty, shall furnish the instruction: viz., one in the management of forests, one in hunting and forest laws, one in natural history, and one in mathematics; these teachers shall be entitled to their years of service, as merits equal to that of forest and chase officers of the kingdom, but the two latter only in case they have graduated at the forest institute. For the appointing of director, as well as teachers, the forest

administration will nominate candidates. At the institute is also a porter, appointed by the director, and who may by him be removed.

"§ 5. The course of instruction shall embrace mathematics and natural history to the extent required for the superintendence of forests and the chase; knowledge of the regulations for the forest and the chase, book-keeping, and the forms for forest accounts; hunting; theoretical and practical knowledge of forest-appraisement; cultivation of woods and forest-technology; and expertness in surveying, map-drawing, leveling, and shooting.

"§ 6. The course of instruction shall be continued during two years, counted from the commencement of the month of June each year, and be so arranged that fully educated pupils may yearly graduate and new ones be admitted in their place.

"§ 7. Pupils who wish to obtain certificates of having graduated, shall, having previously undergone a probation at a public examination, manifest sufficient knowledge and skill in all the branches which they have been taught at the institute. In order to obtain a certificate for forest-management, the pupil must prove himself to have satisfactorily constructed a map. with regular plan of forest surveying and cultivation.

"§ 8. The instruction shall continue during the whole year, with the exception of three weeks' vacation at Christmas, and one week after the yearly examination; and it shall be so regulated, that the pupils acquire, from commencement of October until the end of May, theoretical and such practical knowledge as local circumstances at the institute admit of, and that, during the summer months, the pupils be occupied in the forests of the government, and under the direction of the teachers, with surveying and estimation of forests, and with the most usual modes of the cultivation, care, and felling of trees.

"§ 9. Every year, at the commencement of the month of June, the pupils shall be publicly examined in all the subjects in which they have received instruction. The pupil who, having previously undergone probation, proves himself at the examination to possess the knowledge and skill mentioned in § 7, may without regard to the longer or shorter time he has been at the college, receive due certificate.

"THE DIRECTOR OF THE FOREST INSTITUTE.

"§ 10. The director ought to be one who has proved himself to possess knowledge and experience of forest-managing, and he shall live within the locale of the nstitute, in order to properly exercise his functions. His duties shall embrace, not only the administration of the Institute and responsibility for its operations, and for the completeness of the instruction given; but also the promotion of, the development and the spread throughout the country, of the science of forest-management.

"It shall consequently be the duty of the director—

"1. To quarterly collect from the treasury of His Royal Majesty and the Realm, at the instance of the Forest Administration, the funds assigned to salaries and the maintenance of the institute; to dispose of these funds according to regulations, and each calendar year to render an account of their disposal, which account shall be delivered before the end of the next following February to the Forest Administration to be audited.

"2. To have the charge of the maintenance of the ground, buildings, nurseries, archives, library, collections, tools, implements, and other movables of the institute,

and to see to it that complete lists of the same are made out and always at hand. He shall, however, according to what is stated below, have a right to suitably distribute between the teachers the administration and care of collections, tools, and other movables.

"3. To, having examined the certificates produced, and the amount of knowledge possessed by the candidates for admission, admit them as pupils, and, according to statements of the teachers, separately for each branch, to issue certificates to pupils who have finished their course, and to propose to the Forest Administration the distribution of the assigned stipends among those pupils who shall be considered most deserving of the same.

"4. To issue regulations as well for the maintenance of good order and morality within the Institute as for the suitable course of teaching and the manner of imparting the same, for which purpose the director shall make out a regular table of instruction, so that the business be properly distributed between the teachers, and the time advantageously employed to the benefit of the pupils.

"5. To himself instruct in one of the head branches of forest economy as well as, business permitting, be present at the preliminary examination of the pupils in the other branches.

"6. To endeavour in every possible manner to promote the knowledge and spread of an improved forest economy and management of the chase within the kingdom, for which purpose he must keep himself informed of the progress of the science and technical terms of the forest, also in foreign countries, and to write and publish pamphlets on the subject whenever circumstances require.

"7. To report to the Forest Administration: First, business which may require the decision of His Royal Majesty; and secondly, such steps in regard to an improved forest economy and management of the chase within the kingdom as may be found necessary.

"8. To make such reports or give such information concerning the forest economy and the management of the chase as the Forest Administration may demand, as well as to render to the same yearly accounts of the operations of the Institute; and—

"9. To give to the porter instructions in regard to his attendance and other duties at the Institute.

"THE TEACHERS AT THE FOREST INSTITUTE.

"§ 11. The teacher of forest economy should be one who has graduated at the Institute with honours, and thereafter, on his own responsibility, managed a forest district; and, as his services are constantly required, he ought to live within the Institute. This teacher shall—

"1. Instruct and examine in all the branches of forest economy in which the director himself does not teach, and, further, practically instruct the pupils in surveying and estimating the area of forests, and the cubic contents of trees, in the construction of maps, the valuation of soil, of growing and of felled timber, the collection and preservation of seeds, in the laying-out and care of nurseries, in forest growth and planting, the position of seed-trees, in the felling of trees, assorting and marking of timber; and conduct a party of the pupils in the forests for practical exercise in measuring, estimating, and dividing forest land.

"2. Have under his care, and account for, the archives, library, and movables of the institute, with the exception of those for which the teacher of the chase and regulations is responsible.

"3. Manage the economy and render an account of the forests assigned to the care of the Institute.

"4. Assist the director in seeing that instructions given are followed, and in maintaining industry and order among the pupils; and—

"5. Take command of the place in the absence of the director.

"§ 12. The teacher of the chase and regulations shall be one who has graduated at the Institute with honours, and thereafter served in the forest and chase corps of the Kingdom. This teacher shall—

"1. Instruct and examine in the knowledge of fire-arms, shooting, the theory and technical terms of the chase, forest and chase regulations, and book-keeping.

"2. Assist at the practices in forest economy, and conduct, during the summer season, a party of the pupils in practical measuring, estimating, and dividing of forest land.

"3. Exercise the pupils in target practice, and also, when there is an opportunity in hunting and driving game, instruct the pupils in the care of wolf-pits, traps, nets, and cages; and in the making and the care of hunting implements, in the keeping of forests, and preferring of charges against poachers and other offenders against game and forest laws; and—

"4. Take care of and account for the tools and collections of models of the institute, of the forest and hunting implements, and of what belongs to the target-ground.

"§ 13. The teacher of natural history ought to be one who has proved himself to be thoroughly well acquainted with this science. His duties shall be—

"1. to instruct and examine in those parts of physics, chemistry, and mineralogy which are required for the knowledge of forest climate and soil, in general and forest botany, and in zoology, as far as this branch of knowledge is connected with the forests.

"2. To instruct in the manner of preparing herbaria, and of stuffing and preserving animals and insects.

"3. To conduct the pupils on mineralogical and botanical excursions, and to practice with them the examining of soil and plants.

"4. To instruct the pupils during visits to the museum of the Academy of Sciences; and—

"5. To take care of and account for the zoological and botanical collections of the Institute, and to make out complete lists of the same.

"§ 14. The teacher of mathematics ought to be one who has proved himself thoroughly acquainted with this science. This teacher shall instruct and examine in arithmetic, algebra, planimetry, stereometry, trigonometry, conical sections, geometrical constructions, descriptive geometry, general and forest architecture, elements of mechanics, and theory of the construction and use of mathematical instruments. He shall besides practice with the pupils the drawing and copying of maps, calculating of areas, sketching maps, surveying, construction of buildings and roads for forest purposes, with estimates of materials and labour, measuring of cubic contents, and adjustment of instruments.

"PUPILS AT THE FOREST INSTITUTE.

"§ 15. In order to be admitted at the forest institute, application shall be made to the director in the month of May, with annexed to the same certificates:—

"That the applicant is at least 18 and not above 28 years old; that his constitution is good and faultless, and not affected with any kind of incurable disease; that he has always conducted himself well; that he either has passed examination and obtained certificates of approval in mathematics, natural history, and Swedish grammar, which entitle him to enter the universities of the Kingdom; or that he has been examined by the appointed teachers at one of the elementary schools within the Kingdom in each of these branches, and found to possess sufficient knowledge therein to enable him to graduate from the school; also, that he has, during at least one year, with some forester practised and acquired sufficient skill in the economy and surveying of the forest.

"§ 16. Applicants whose applications are complete, and who consequently may expect to fill the vacancies at the Institute, must publicly and in the presence of the director be examined by the teachers in arithmetic and algebra, planimetry and stereometry, general botany, and zoology; and also write a theme in Swedish.

"§ 17. Those exhibiting the greatest knowledge shall have the preference in being admitted to the Institute.

"§ 18. At the commencement of every year the director shall propose to the Forest Administration for the receiving of stipends those of the pupils who are in need of assistance, and have shown themselves most deserving of the same through industry, skill, and orderly conduct.

"§ 19. The pupils shall obey the orders of the director and of the teachers, shall conduct themselves orderly and decently, conform to the regulations of the Institute, and attentively and industriously profit by the instructions given.

"§ 20. Should the pupil disobey the orders of the director or the teachers, create any disturbance at the institute, conduct himself in a disorderly manner, or neglect his studies, he shall receive warning from the director. Should he not then change his conduct, but continue his offences, the director shall, after having consulted the teachers, dismiss him from the Institute.

"CHAP. II.—THE PRIMARY FOREST SCHOOLS—THEIR OBJECT AND ORGANIZATION.

"§ 21. Suitable houses, large enough to permit both teachers and pupils to live there, shall be placed at the disposal of the forest schools at such places as shall be especially determined upon.

"§ 22. To a certain number of pupils, unable to maintain themselves at the school, sufficient assistance shall be given, according to what is thereanent specially prescribed.

"§ 23. The forest schools shall be managed, under the superintendence of the nearest District Director of forests, by a teacher appointed by His Royal Majesty the King, after having been proposed for the situation by the Governor of the province and with the approval of the Forest Administration; this teacher shall be assisted by a ranger, nominated by the Forest Administration.

"§ 24. The instruction at the forest schools shall embrace the first four rules of arithmetic and the rules of proportion in whole and decimal numbers; knowledge of scales for plan-drawings, as far as is required for making maps and measuring distances; knowledge of square and cubic meaures with practical applications of the mensuration of the extent and contents of surfaces and of solid bodies; knowledge of the organs of nutrition in forest trees and of their food, and the natural conditions for their thriving; knowledge of the insects most dangerous to the Swedish forests, and of the manner of destroying them; the chief principles of

rational forest economy, and knowledge of the existing rules for the police keeping of forests, for marking and carrying timber, and hunting, and also of the legal forms for entering charges. The pupils shall also be practised in marking out and measuring forest-lines; tilling ground, and sowing fields; calculating the cubic contents of trees and timber; the position of seed-trees; hand-sowing and planting as well as the preparing of the soil for forest-growing; collecting and assorting of forest-seeds; clearing and cutting, assorting and piling of timber; marking cattle and making out of grazing lists; laying up and keeping patrol-lists; making out lists of unlawfully-felled timber on which embargo has been laid; monthly reports and service accounts; the trapping of beasts, and the grand chase.

"§ 25. The course of instruction shall begin on the 1st of October every year, and continue until the middle of the following June, during which time all the several subjects and exercises shall have been taught to the pupils, whereafter they are publicly examined in the presence of the District Director in order to ascertain the knowledge and skill they have acquired.

"§ 26. The pupil who has satisfactorily passed the examination is entitled to receive certificate of approved skill, issued by the District Director and the Principal of the school.

"THE TEACHER OF THE SCHOOL.

"§ 27. For appointment as teacher at the forest school, which office entitles him to count the time spent as years of service in the forest and chase corps, the applicant must have graduated at the Forest Institute and received certificate of approved knowledge, besides having been forest-manager on his own responsibility. The teacher is the chief in command at the place, the principal at the school, and he accounts for and is responsible for the proper management of the school. He shall, consequently, quarterly, receive the funds assigned to the school, use them with judgment, and yearly account for the same, which account shall, within the time specified in §10, par. 1, for the Forest Institute and for the object mentioned in the said par. be forwarded to the Forest Administration through the Governor of the province. It shall, besides, be his duty to arrange the teaching and exercises for the benefit of the pupils; to keep good order and decent conduct within the school; to himself impart the theoretical knowledge, and superintend and correct the exercises and work in the forest. He shall also render a yearly report of the operations of the school, which shall be forwarded to the Forest Administration through the Governor of the province.

"'SKOGSRAETTAREN,' OR ASSISTANT.

"§ 28. The assistant must have proved himself as steady and orderly, to be able to write, and well acquainted with all kind of forest-works. He is subordinate to the direct command of the teacher; he has the care of all the implements and materials of the school, for which he is responsible and must account to the teacher; he manages the school in the absence of the teacher, he is responsible that the exercises and works are properly done, and he assists in keeping good order among the pupils.

"THE PUPILS OF THE FOREST SCHOOL.

"§ 29. Those who wish to be admitted to the forest school must make their application to the principal in their own hand-writing, with annexed certificates

from a clergyman, of good conduct, and of good and faultless bodily constitution, and if the applicant has been in service, a certificate of service; the applicant must be able to read fluently Swedish and Latin letters and writing, write a legible hand, know the first four rules of arithmetic, and be from twenty to thirty years of age.

"§ 30. Having examined the applications and the applicants, the principal of the school shall admit as pupils the most skillful and best conducted.

"§ 31. The pupils shall obey the orders and directions of the teacher and the assistant, and maintain industry, order, and good conduct. Should the pupil disobey the teacher, or the assistant, transgress the rules of the school, be neglectful or disorderly in his conduct, or should he create disturbance, he shall receive warning of the Principal; should he not then change his conduct, but continue his offences, the Principal shall dismiss him from the school.

"CHAPTER III.—PRIVATE FOREST-INSTRUCTION.

"§ 32. To the establishment of forest schools in the several provinces of the kingdom, and to the education of competent assistants for the managing of private forests, His Royal Majesty and the government will, yearly, contribute as much as the funds will permit and His Royal Majesty shall deem requisite, provided the communities which apply for such an assistance shall fulfil the following conditions:

"1. That the community place a requisite building at the disposal of the school, furnish the teacher as well as the pupils with apartments, and pay for the maintenance of the school.

"2. That the organization of the school and the proposed rules for its operations be sanctioned by His Royal Majesty; and,

"3. That the operations of the school, of which a yearly report shall be made to the Forest Administration, shall be conducted under the superintendence of the nearest District Director and the Forest Administration.

"In regard to the time for applying for appointments as director, teacher, and assistant, and for resignations, and how leave of absence shall be applied for or charges preferred for offence and neglect in service, as well as the punishment thereof, the regulations prescribed in the instructions for the Forest Administration shall be in force.

"All of which regulations all whom it may concern shall obey.

"In witness whereof we have hereunto set our hand and caused our royal seal to be affixed.

"The Palace at Stockholm, May 25, 1860.

CARL. [L. S.]

"J. A. GRIPENSTEDT.

The forest schools supported by the Government are located at the following places:—Tierps, Upsala county; Ombergs, Ostergötland county; Böda, Calmar county; Daniels-Lands, Christianstad county; Hunneberg, Elfsborg county; and Silbre, Western Norrland county. From the report of 1867 it appears that 21,850 pupils in the "folk-school," or common school, received instruction in horticulture and tree-planting; and the Government offers help to support

additional forest schools where local authorities take the initiatory steps to establish them.

A graduate of a forest school can be employed as a forest watchman at about 300 rix-dollars per year and use of a dwelling and patch of ground. A rix-dollar is equal to 4s 4¾d sterling.

The Royal Forest Institute in Stockholm is pleasantly situated on a rise of ground in a grove close to the bridge as one turns from the city to enter the deer park.

Graduates are regarded as members of the forest "stat" or establishment, and are in the line of promotion therein: their first appointment being that of assistant forester, which is generally received immediately after graduation, and opens the way to their earning about 600 rix-dollars a year in surveying and other work connected with forests. In ten years they can be promoted to "Jäg mästere," or forester. Above this last office is the position of forest inspector, which has been created for three or four years. 15,300 rix-dollars are annually appropriated for the support of the Institute.

In Sweden it is the practice in every branch of the public service and department of instruction to allow money for the travelling expenses of persons sent abroad to obtain information; and sums varying from 500 rix-dollars to 1,200 rix-dollars are often granted for travelling in foreign countries on forest purposes.

It was in France that modern forest science received its first development; and much was thus accomplished in the course of the last century. The French revolution and consequent wars interrupted the progress of this science in France; but it then shot up rapidly in Germany in the hands of Hartig and Cotta, and under their teaching. And on the re-establishment of peace the study was resumed in France by Lorentz and Parade, who found worthy successors in MM. Nanquette, Clavé, Tassy, and others. What is sought, as is stated by M. Parade, is to secure a sustained production of timber, by the replacement by annual growth of what is annually removed, combined with a natural re-sowing of the ground, and a progressive, ever-advancing improvement of the forest.

With the introduction of the new treatment of forests, in accordance with the *methode des compartements*, it was seen that in order to the carrying out this thoroughly and efficiently it was necessary to have agents educated, instructed, and trained with a special view to the prosecution of the work. And in 1824 there was established at Nancy a school for the study of all that is connected with forest

culture and forest economy, such as had then been established in various parts of Germany.

In 1827 there was promulgated by Charles X a new forest code, *Le Code Forestiere*, in which were embodied all provisions made by laws previously issued applicable to the newly introduced method of forest management, while what was not so applicable was either modified to meet the requirements of the new *régime*, or was abrogated and declared to be so. And this was followed by the promulgation in the same year of an *Ordonnance Reglementaire*, or *Ordonnance du Roi pour l'execution du Code Forestiere*. And these with a few subsequently ordained modifications of particular articles constitute the existing Forest Law of France.

In this Code it is ordained :—*Sect* iii.—"40. There shall be, under the supervision of the Director-General of forests—(1) a Royal School designed to train candidates for employment as forest agents. And (2) Secondary Schools for the instruction of pupil guards.

"41. The instruction in the Royal School shall embrace natural history, in its relations to forests; mathematics, applied to measurement of solids and to the drawing of plans; legislation and jurisprudence, administrative and judicial, in forest matters; forest economy, in what concerns specially the culture, the management, and the exploitation of forests, and the production of trees proper for naval purposes; drawing; and the German language.

"42. The Minister of Finance shall appoint three professors, to be attached to the Royal Forest School, namely: a professor of natural history, a professor of mathematics, a professor of forest economy, legislation, and jurisprudence. The courses of instruction shall last two years. They shall commence on the 1st November in each year, and close on the 1st September following. One of the three professors shall discharge the functions of Director of the school. A drawing-master, and a German master, shall be attached to the Royal School.

"43. The Royal Forest School shall be established at Nancy. There shall be appropriated to this school—(1) a house to serve for lecture-rooms for the professors, the establishment of a library and a museum of natural history, and a dwelling for the director. (2) A piece of land for the nurseries and forest cultures requisite for the instruction of the pupils.

[The original Article, No. 44, was superseded by the following provisions in Ordinance of the 3rd May, 1834.]

"In future the number of pupils to the Royal Forest School shall

be determined each year by the Minister of Finance, according to the wants of the administration of forests.

"By ordinance of 21st December, 1840, candidates who shall present themselves for admission to the Royal Forest School are examined in Paris, and in the departments by four examiners, designated annually by the Minister of Finances.

"The examinations shall take place in the same way, at the same time, and in the same places, as those for admission into the military schools.

"Candidates shall only be admitted to the competition on the presentation of a letter from the Director-General of the administration of forests.

"Application for admission to the competition should be addressed to the administration before the 20th June, with the following documents in support of the same—(1) certificate of birth, duly attested, proving that the candidate will be on the 1st November at least nineteen years of age, and not more than twenty-two. (2) A medical certificate from a physician, duly attested, proving that the candidate has been vaccinated, and has no deformity or infirmity, which would unfit him for the forest service. (3) The diploma of bachelor in literature. (4) Proof that the candidate possesses an annual income of at least 1500 francs, or in default of this an obligation by which his relatives engage to supply him with such a sum during his residence at the forest school, and an allowance of 600 francs in addition to his salary from the time he shall leave the school until he shall be employed as general guard on active service."

[Article 45 was superseded by the following by ordinance of 21st December, 1840].

"The admission examination to the forest school shall be on the following subjects: namely—(1) arithmetic in all its branches, including the new metrical system; (2) elements of geometry; (3) rectilinear trigonometry; (4) elements of algebra; (5) elements of descriptive geometry; (6) elements of statics; (7) elements of physics; (8) elements of chemistry: (9) drawing; (10) the French language; (11) the Latin language; (12) the first elements of the German language.

"A programme, decreed by the Minister of Finance, shall determine in regard to each subject the amount of knowledge which every candidate shall be required to have attained."

"46. The pupils shall be appointed by the Minister of Finance and this shall be done in the order of the marks assigned them for

proficiency and capacity as the results of their examination. And they shall have, during their stay at the school, the rank of mounted guardsmen."

By the same ordinance of the 21st December, 1840, it is ordered: —"On their arrival at the school the pupils shall be visited by the medical attendant of the establishment, that he may certify that they have no deformity or infirmity which would render them unfit for admission to the school courses, or to the forest service.

"47. There uniform shall be as follows, &c.

"48. The pupils shall each year make excursions in the forests with a view to obtaining demonstration, and making application on the ground, of the principles which have been taught to them; these shall be made at times indicated by the Director-General, and under the guidance of the Professor, who shall be designated to this duty.

"49. At the close of each year a jury, composed of the three Professors, and presided over by the Director-General, or by the Administrator, whom he shall depute, shall proceed to an examination of the pupils who shall have completed their two years of study.

"50. The pupils who shall have passed satisfactorily this examination shall have assigned to them the rank of *garde general*, and shall obtain, on attaining the prescribed age, or a royal order of dispensation in regard to age, the first vacant appointment open to men of that rank.

"51. If the pupils, after having terminated the prescribed course of study, and given proof of possessing the required knowledge, have not attained the age of twenty-five years, nor obtained a royal dispensation in regard to age, if there be no vacancy for appointment as general guard, he shall have the allowance of mounted guard, and shall be temporarily employed by, it may be, the general directory at Paris, or by, it may be, the conservator or the inspector in some one or other of the most important arrondissements.

"When they shall have fulfilled the condition of age, and vacancies occur, they shall have employment prior to, and in preference of other pupils who may have subsequently completed their courses of study.

[The first clause of 52 was modified by ordinance of the 15th December, 1841, to the following effect]:—

"The pupils who, after the first or the second year, shall not have given evidence before the jury of examination of sufficient proficiency shall be struck out of the school list, unless some serious illness duly certified has occasioned in the course of the year an interruption of

at least forty-five days to their school labour; in this case they can be admitted, by a decision of the jury, to repeat the studies of the first, or of the second year, as the case may be.

"This power of repeating the studies cannot be granted for any other cause; and in no case can the students remain more than three years at the school.

"In the case of those who, according to the periodical reports made to the Director-General of forests by the Director of the school, shall not have followed exactly the courses prescribed, or whose conduct shall have given occasion for serious complaint, the case shall be referred to the Minister of Finance, who shall order, if there be occasion so to do, the erasure of the name from the school list.

"53. The Minister of Finance shall determine by a special regulation the division of the courses, the classification of the pupils, the order and hours of lessons, the police of the school, and the functions of the Director.

"54. Secondary schools shall be established in the most richly wooded regions of France. They shall be destined to train men for employment as guards. The length of the course shall be two years.

"55. The instruction in the Secondary schools shall embrace—(1) writing, grammar, and the first four rules of arithmetic.

"(2) The knowledge of forest trees, and of their qualities and uses, and especially those of trees fit for employment in civil and naval architecture.

"(3) Sowings and plantations.

"(4) The principles of management, estimates, and exploitations.

"(5) The knowledge of legislation, provisions, and regulations which relate to the duties of guards; the preparation of official reports; and the formulas in which they must be couched; citations; the keeping of a day-book; and the exercise of rights of usage.

"56. We shall determine by a special ordinance the places where the Secondary schools shall be established, the number of pupils, the terms of admission, and the means of providing for the maintenance and instruction of the pupils of these schools."

In the subsequent legislation of France there are numerous references to this intention. So far as is known to me, none of the *Ecoles Secondaires*, designed for the training of Forest Warders, have been organised; but facilities for studying at the School of Forestry at Nancy have been increased, by the establishment of scholarships, or bursaries, to sons of officials in the service. To these relate a

Decree of 31st July, 1856, and a Ministerial Order of 17th September, 1856.

Several of the arrangements in regard to the number and the duties of the professor, provided by Article 42, have been abrogated or modified by the following Ordinance:—

"Ordonnance du 31st October, 1838.—Art. 1. The studies of the Royal Forest School are directed by six professors: namely, a professor of forest economy; a professor of legislation and jurisprudence; a professor of mathematics and physics; a professor of natural history and of chemistry; a professor of forest buildings and of draining; and a professor of the German language.

"Two inspectors are attached to the school.

"Art. 2. The professors and inspectors constitute part of the jury of examination instituted by Article 49 of the Ordonnance of the 1st August, 1827.

"Art. 3. The duties of the inspectors are to secure the daily execution of the regulations in regard to the police and instruction, and to superintend the works and the behaviour of the students, inside and outside the establishment.

"Art. 4. The Minister of Finance shall determine the salaries of the professors and the inspectors, and their promotion in connection with the school. Such of these functionaries as shall be taken from among the forest agents shall preserve their rights of promotion in the active service."

By Order of the Director-General of Forests, of the 24th November, 1857, it is declared:—"Art. 1. From the 1st of January next, till further orders, two brigadiers shall be detached from the active service, and employed in the surveillance of the students of the forest schools as adjutants.

"Art. 2. The adjutants shall be appointed by the Director-General, on the proposal of the Director of the school. They shall have the rank and salary of *gardes generaux adjoints*."

By Ordonnance of 17th December, 1844, Art. 83, it was determined that the appointment of the Director of the Forest School should be by the Crown, on the proposal of the Minister of Finance.

Art. 44 was a modification of the original Article, which only provided for the examination taking place in accordance with what is stated in the first paragraph of the ordinance of 21st December, 1840, and the production of the certificates mentioned in that ordinance. But this was, in time, still further modified. With regard to parties admissible to the school, it was decreed, by Decree of 1st November,

1852 :—"Art. 68. The students *(de l'ecole polytechnique)* admissible into the public service, who, from lack of vacancies, could not be appointed to any of the services enumerated in Art. 1 of the Decree, may be received into the Forest School."

By decision of the Minister of Finance, of the 11th November, 1861, it was arranged :—"Places for free auditors, to the number of from twenty to five and twenty, in the amphitheatre of the Imperial Forest School, shall be put at the service of Frenchmen or foreigners who shall make application for them.

"The application shall be addressed, before the 1st of September in each year, to the Director-General of Forests, who shall thereupon decide in regard to granting it."

By Decree of the 2nd January, 1861, it was decreed :—"Art. 1. In future, no one shall be admitted to compete for admission to the Imperial Forest School if he do not furnish proof that he shall, on the 1st of November in the year of competition, have completed his eighteenth year, and be under twenty-five years of age."

Article 45 was also a modification of the Article originally issued ; and this also was subsequently modified.

By terms of the regulations for admission to the Forest School, approved by the Minister of Finance on the 24th February, 1864, the examination of the candidates was to be on the following subjects : namely, (1) arithmetic in all its rules ; (2) the elements of algebra ; (3) elementary geometry ; (4) applications of geometry ; (5) rectilinear trigonometry ; (6) elements of physics ; (7) elements of chemistry ; (8) elements of cosmography ; (9) elements of mechanics ; (10) elements of botany and vegetable physiology ; (11) history of France, and geography ; (12) drawing, mechanical drawing, and colouring ; (13) the French language ; (14) the elements of the German language.

The trials consist of oral examinations and written exercises. The oral examinations are conducted by the examiners of candidates for the Polytechnic School. They are divided into two portions : first degree examinations, and second degree examinations. The written exercises are executed in each Centre of Examinations, under the superintendence of forest agents designated by the Director-General.

On the points to which Article 46 relate, it was further enacted, by ordinance of the 12th October, 1840 :—"Art. 1. Every year, after the circuits of examinations, there shall be formed, at Paris, a jury charged to pronounce on the admission to the Forest School of candidates examined throughout the kingdom. This jury shall be

composed of the Director-General of forests, president, the sub-director of the administration, the director of the school, the four examiners for admission, and the professor of *belles-lettres*, who shall be charged annually by the Minister of Finance, on the proposal of the Director-General, with the work relative to the literary compositions.

"Art. 2. The jury shall prepare a list, in the order of merit, of all the candidates judged admissible, and the Minister of Finance shall order the admissions, following the order of this list up to the number of places to be filled."

By Ordonnance of the 17th December, 1844, Art. 84, it is ordered that the appointments should be made by the Minister of Finance on the proposal of the Director-General.

In regard to disqualifications, it is stated that very bad sight is considered a physical disqualification.

Article 47, which prescribes the uniform of the students at the Forest School of Nancy, contained originally a second paragraph to the effect that half of the students should always be expressly nominated for the salary of mounted gaurds on active duty. But this paragraph was abrogated by an ordinance of the 15th Dec., 1837.

Instruction is given gratuitously to those who prepare for the State Forest service. But, according to the latest information in my possession, parents or guardians have to pay the following sums for board and lodging, the purchase of the uniform, and the requisite mathematical and other instruments.

	Francs.
1. On entering the school, for uniform and instruments, -	900
2. For board and lodging, attendance, and other ordinary expenses, at the rate of 1,500 francs per annum, -	3,000
3. For pocket money, not exceeding 600 francs per annum,	1,200
Total expense for 2 years,	5,100, or £204.

According to the official *Programme de l'enseigement de l'Ecole*, issued last year, 1876, the course of study in connection with the school extends over three years; instruction being given during two years to pupils in accordance with the requirements of the code, and in a third year to advanced students designated *Les Gardes generaux stagiares*, or Licentiates.

The programme of study fills 118 pages quarto.

The Winter Session of the first year embraces the six months from 1st November to 1st May. The daily work extends over ten hours,

and arrangements are made to secure that 1500 hours in all shall be spent in study in the course of the session.

There are given seventy-five lectures of an hour and a half on forest economy; and an hour and a half is allotted to preparation for each of these and subsequent study.

The subjects discussed relate to sylviculture, the exploitation and the disposal of timber; bringing under consideration climates; soils; the natural history of different kinds of trees; the management of forests; different methods of exploitation; the conversion of one form of forest into another; and artificial plantation; the practical application of different methods of expolitation; the disposal of felled timber; and the desirable qualities and the defects of woods.

In the same session a similar amount of time is given to the study of botany, in seventy-five lectures of an hour and a half each, with an hour and a half spent in study and reading on the subject. In these attention is given in succession to the structure, organs, physiology, nomenclature, and geographical distribution of plants.

Seventy-five lectures of an hour and a half, with the same amount of time for study, are devoted to what is embraced under the designation of mathematical studies, with 162½ hours spent in drawing charts, diagrams, &c. Of the lectures twenty are taken up with land-surveying and levelling; and fifteen hours of effective work under the direction of the professor are given to the preparation of plans, twenty-two hours to elevations in water colours, twenty-two hours to sketches and descriptions of rising grounds of limited extent, twenty-five hours to diagrams and calculations of polygonal figures of limited extent, and twenty-eight hours to elevations and designs in hatchwork.

Eight lectures are given to the study of road-making, in all its departments; with thirty-six hours of effective work, under the direction of the professor, to the preparation of working diagrams of a projected road; and twenty-three hours to calculations of the line of transport from cuttings to embankments, and calculation of cubic measurements by the exact method, and by the rougher method securing only an approximation.

Twenty-two lectures are given to the study of constructions or erections in wood, metal, brick, and stone, with all that relates thereto; and sixty-six and a half hours of effective work, under the direction of a professor, are given to the preparation of a plan and elevations of a dwelling-house; and 83½ hours in the second year of study to the plan and elevation of a vaulted bridge, and of a bridge of wood.

Fifty lectures of an hour and a half, with similar time for study and preparation, are given to the subject of law; in these are discussed successively the organisation and functions of the public authority and legislation—administrative and judiciary; the forest service; rights of property, and security for the same; and the legal and judicial course of procedure for the repression of injurious attacks upon forest property.

Fifty lectures of an hour and a half, with the addition of half that time for study and preparation, are devoted to the German language, which is very rich in literature relative to Forest Science. In these attention is given specially to botanical and agricultural terms; to the relation of the language to other languages, ancient and modern; and to the use of the article, the substantive, the adjective, the pronoun, and the verb. Every week a theme is written, which is corrected at the table, and phrases are dictated and translated off-hand at the table; while explanations are given of short pieces in prose and verse.

Twenty-five lectures of two hours duration are devoted to military instruction, with one hundred hours devoted to drill, seventy-five to horsemanship, and, if I am not mistaken, a hundred to drill on horseback, in the course of the session.

In these lectures, instruction is given in the principles of projectiles; in all that relates to shooting, and to different kinds of fire-arms; in the existing military laws; in the military administration, as this relates to a body of troops, to all that pertains to the individual soldier, and to the internal administration and mobilisation of a troop; theoretical instruction from a hand-book is given in regard to the soldier under training, in military service in the interior, and in service on duty in time of peace. With these are given military exercise, within the precincts of the school, in individual drill, in company drill, and in rifle shooting; and military exercise, outside the school, in target-shooting, in individual drill, and in campaigning; and 150 hours are allowed for private studies.

The Summer Session of the first year extends over the four months from 1st May to 1st Sep., after which follows a vacation of 2 months.

Thirty-one days are spent in botanical and professional excursions in l'Aisne, l'Oise, the Vosges, the Doup, and the Jura, in which are visited forests of all kinds in all stages of treatment and exploitation; and the students are required to exercise themselves in the mensuration of wood and timber for sale.

Six days are alloted to the preparation of a report of the tour of observation, and the preparation of an herbarium of plants collected.

Seven days in the field and fifteen hours in the study are given to the preparation of a diagram, with a report and calculations, etc., of everything relative to a topographical plan, including levels, and a reduced drawing of the same; and one day, in each section of the forest visited, to the mensuration of a supposed felling, and the preparation of an official report of it.

Five days of work on the ground, under the direction of the two professors, are given to the study of an imaginary projected road; and twenty days of effective work, under the direction of two professors, to the construction and draught of working drawings, and to the preparation of the different portions of an estimate or specification, relative exclusively to embankments.

Six days are spent in military reconnaissance, and in giving a report and sketch; and in competition in rifle-shooting.

Twenty-one days are devoted to examinations and preparation for these; and eighteen days are spent as holidays.

The Winter Session of the second year embraces the six months from 1st November to 1st May, and, as in the winter session of the first year, ten hours daily are demanded by the work.

In this session there are given seventy-five additional lectures of an hour and a half on Forest Economy; and an hour and a half is set aside for study and preparation for each.

The subjects discussed during this session relate to the management of woods and forests, and the formation of requisite estimates; there are discussed the fundamental principles of the administration of the management of forests, as affecting the *régime* of timber trees, or of coppice woods, etc., etc.; the age of trees to be felled; the arrangement of the forest into a series of divisions, in accordance with the requirements of the advanced methods of forest economy; the time to be allowed for a revolution, or forest crop, and its restoration; the prescription of fellings, etc.; the survey of a forest, with a view to the application to it of the fundamental principles of management; the application of these to the management of timber forests and of coppice woods, and the conversion of these from one of the states into the other; the formation of estimates of the cubic measurement of standing woods; different modes of disposal of woods by sale; and the formation of estimates of the value of standing woods.

Seventy-five lectures of an hour and a half, with a similar allowance of time for study, are devotted to mineralogy, lithology, geology, and the geological features of France.

Fifty lectures of an hour and a half, with similar time for study and preparation, are devoted to what is included under the head of mathematics. Of these, fifteen are devoted to a continuation of the course of lectures on levelling, and to trigonometrical surveying; and twenty-eight hours of effective work, under the direction of the professor, are given to the preparation of diagrams and copies of the several levellings taken in the course of the excursions in the previous summer, with thirty-two hours to the preparation of a diagram and description of all these combined. And thirty-five lectures are devoted to the consideration of everything connected with saw-mills; and forty-five hours of effective work, under the direction of a professor, are given to the calculations required for a prescribed saw-mill of double gear; and thirty-five hours, under the same director, to the preparation of designs of two projections of the inferior stage of the saw-mill in question.

In this session also, fifty lectures of an hour and a half, with an equal time for study and preparation, are devoted to law. In these is completed the discussion of the legal and judicial means for repressing injuries to forest property; and there is discussed the different tenures by which property is held, and the restrictions and obligations which property imposes; legal relations affecting property, through land servitudes, through forest usage, and other conditions; legal relations of persons in regard to these, in relation to usufruct, usages, hypothec, etc.; legal relations between parties in regard to purchase and hiring; and legal rights in connection with State forests and forests belonging to communes.

Fifty lectures of an hour and a half, with the addition of half of that time for preparation, are given also in this session to the acquisition of the German language. In these attention is given specially to terms used in forest economy, and to terms used in speaking of the qualities and defects of wood, and in speaking of soils, geology, chemistry, game, and insects; in grammar attention is given to prepositions and conjunctions, to the structure of sentences, and to the formation of words; every week a theme is written and corrected at the table; phrases are dictated and translated; and explanations are given of short pieces in prose and in verse.

In the class examinations the students are expected to answer in German all the questions put to them in the progress of the course

of instruction; to commit to memory the dictated words and the corrected themes; to reproduce the original text of translations which the professor gives to them in French; and to treat in German any question in grammar which may be raised; and it is expected that at the end of the year they should be able to translate *ad aperturam libri* any passage taken at hap-hazard from a writer in prose or in verse.

In this year military instruction is resumed; again twenty lectures of two hours are given; and a hundred hours are spent in drill, seventy-five in the riding school, and, if I am not mistaken, a hundred in cavalry drill. This year instruction is given in the use of artillery and in fortification. The former embraces all that relates to the gun, to the rolling material, to the artillery organisation, and to the construction and repacking of moveable bridges. The latter embraces all that relates to temporary fortification, and to fortifications improvised to meet an emergency. Theoretical instruction in regard to company drill, and to campaigning, and to service on duty in time of war is given; and with this are given military exercises within the precincts of the school in individual drill, commanded by pupils; in company drill, commanded by pupils; and in carbine shooting and military exercises outside in individual drill, and in company drill, both commanded by pupils; and, as in the first session, 120 hours are allotted to private study.

The Summer Session of the second year embraces the four months from 1st May to 1st September, and is followed by a vacation of two months.

In this session twenty-three days are spent in the forests of Meurthe-et-Moselle and of the l'Aine, in the study of the management of a series of fellings formed of mixed timber, and of coppice being converted into timber forest, and in the study of the actual management of a timber forest; and fourteen days are allotted to the preparation of reports on what has been seen.

Two days are devoted to land-surveying, six to trigonometrical surveys, and eleven to the study of saw-mills in the Vosges: in the former, under the direction of two professors, they make a trigonometrical survey of a forest in the environs of Nancy, or of the Vosges, reconnoitring the ground, planting signals, measuring a base line, and observing the angles. And twelve days are allotted to the preparation of diagrams and calculations, in the class room, under the direction of two professors; and under the direction of the same

in making a complete calculation of the net-work of angles, a connection of this net-work with the lines on the map of France, a calculation of the co-ordinates, and a report on the plan.

One day in each section of forest visited is spent in a felling, and in the preparation of an official report in regard to it.

In connection with the saw-mills five days of work on the ground, and six in the class-room, are given to preparing a sketch and a description of diagrams of the mechanism of five saw-mills, selected from amongst the kinds most frequently employed; to experiments in the gauging of water-courses, the effect of water-wheels, and the time required in the work of sawing; to the general co-efficient of waste; and the preparing of a memorandum of the calculations and observations made in the saw-mills visited.

Eight days are devoted to military reconnaissance, with a view to meet a proposed problem in regard to tactics, of which there is required a report and sketch.

And at the end of the year the student is subjected to theoretical and practical examination on, with a trifling exception, all the subjects of study embraced by the course. Twenty-eight days are alloted to these examinations and to preparations for them, and eighteen days are allowed as holidays.

The Winter Session of the third year extends over the four months from 1st November to 1st April, and is attended by advanced students, who may be required to take the place of *Gardes généraux*, and who, while so employed, are not required to attend the classes—but they are required to spend two days a week in the *bureaux de l'inspection*, and of the *chefs de cantonnement*, and in such proceedings connected with the administration as may be going on; and by all two days a week are spent a-field in all the departments of work required to be carried on in the forest.

In this session forty lectures of an hour and a half's duration are devoted to subjects embraced in forest statistics, and to the elements of political economy.

Ane forty lectures of similar length are given to zoology, with special attention to entomology, the ravages committed by insects upon forests; the means of averting them, of destroying them, and of recovering a forest ravaged by them.

In this session the study of law receives continued, extended, and greatly increased attention. Twenty lectures of an hour and a half are given to the consideration of the legislation relating to the chase,

the fixation of sand-dunes, and the *rêboisement* and *gazonnement* of the mountains; and forty lectures of three hours' duration to the principles of the administration and management of a cantonnement, and allied subjects.

There are discussed the subjects of civil pensions, of hospitals for the aged, fire and life insurance, and banks; and the students are trained under the direction of the professors in the preparation in official style of all kinds of documents which can be required of them in the forest service.

In regard to Dunes, there are discussed the geological relations and the natural history of these; the laws in regard to them, their several relations, and the measures adopted in the fixation of them.

In regard to the *Reboisement* and *Gazonnement* of mountains, there are discussed the geology and the mineralogy of the mountains in France; torrents, the cause of their formation and the means of extinction; the laws existing in regard to the subject, the methods of work adopted, and the works executed.

Forty lectures of an hour and a half are given to instruction in the German language, in which there is given a recapitulation of all the terms used in forestry; versions and dictations are given at the table; an explanation of Faust is given, and translations of articles taken from reviews treating of forestal or scientific subjects are required.

Forty lectures of an hour and a half are given to the study of agriculture: the laws regulating vegetable and animal production; and agriculture, strictly so called. Under the first of these heads is discussed the chemistry of vegetation, and all that relates to the production and assimilation of atmospherical and terrestrial elements. Under the second, all that relates to the nutrition and alimentation of stock, forage, and the production of flesh, of milk, of wool, etc.; and of muscular power to be employed as a motive power. Under the third head is discussed all that relates to agricultural implements, to cereals, to pasturages, to fruits, to economic products of agriculture and their preparation, and to artificial manures.

The Summer Session of the third year embraces the five months from the 1st April to the 30th August. The month of April is spent in taking part in all the operations of marking trees, and gathering in the products of State forests and of communal forests at the service of the school, and the preparation of an official report of the marking of

trees and estimates of the products collected; the months of May and June in the study of forest work in the oak forests of Central France, in the coniferous forests of the Vosges and of the Jura, and in the perimetres of *réboisement* and *gazonnement* on the Alps; and the month of August in the preparation and presentation of a personal memoir of this study and examinations.

The designation *Ecole Forestière* had previously been given, and still is given, to an important establishment formed by M. de Vilmorin on property belonging to him at Barres, in the department of the Loiret, and which is now maintained by the Government as *L'Ecole Forestière des Barres.* This, strictly speaking, is a Forest School; while that at Nancy, strictly speaking, is a School of Forestry.

It is such as the Arboretum might be made, without detriment to its maintenance, as a pleasant resort for rich and poor, seeking only relaxation and enjoyment.

The designation *Ecole Forestière*, or Forest School, was given to the establishment apparently in contradistinction, on the one hand, to *Nursery*, a designation borrowed from domestic life; and in contradistinction, on the other hand, to a plantation or forest, it being a collection of trees raised from seed obtained from forests, or from nurserymen and seedsmen of note, and reared with a view to the study of their habits, their identity, and their differences.

The design of M. de Vilmorin and the results of his operation we learn from himself. He died in March, 1862, a venerable man, full of years and of honour,—*Membre de la Société Impériale et Centrale d'Agriculture de France*, and *Correspondent de l'Institut.*

The *Bureau de la Société d'Agriculture* in collecting documents, of which they might avail themselves in preparing a historical notice of their honoured colleague, learned that he had written a history of his experiments, and procured from his family a copy of this document with permission to publish it in their memoirs.

In the introduction to this record, which related exclusively to this establishment, which was only one of many experiments and related researches with which his valuable life was occupied, he says:—"The work or treatise, of which this is but the first part, has for its object to report collected observations made during a long course of years on the trees composing the *collection forestière*, which I have made on my estate of Barres. Studies of this kind have at this day a much greater interest for France than they ever have had before.

"The forests which, in a former day covered a great part of her territory, are, if not entirely destroyed, at least so much reduced that the products are far below her actual requirements.

"For a long time now France has been dependent on the foreigner for a considerable portion of the timber requisite for the maintenance of her navy, and more especially for wood suitable for masts. Throughout nearly the whole of the last century masts for the navy were only to be found in the Baltic ports, and chiefly in Riga, and now that timber of very great dimensions fit for this purpose are only to be obtained at great price, we find it necessary to draw a great portion of our supplies from the United States.

"This condition of things is not only a heavy burden on the treasury, but may become matter of grave concern in case of eventualities, against which it is necessary to provide.

"France, by the single fact of her geographical position, with her two hundred leagues of coast on two seas, with her colonies, and Algeria, and her distant commerce to protect in all parts of the world, cannot avoid being a maritime power of the first order—it is one of the necessaries of her existence. She can no more relieve herself of an imposing naval force than of an army.

"But for the construction and maintenance of numerous vessels of war, it is needful that she be able to find on her own soil the needed timber.

"Those portions of the soil which have been conquered from the forest by agriculture cannot be recovered. But France still possesses considerable resources besides these. For instance a large extent of the mountains have been despoiled of forests; the re-covering of these with trees is acknowledged by every one to be an urgent and indispensable measure; besides, there are hundreds of thousands of hectares in one district of the west and of the south central France, which have continued hitherto in a state approaching utter unproductiveness, which are capable of bearing beautiful timber forests of resinous trees. It is on these lands, and by the employment for the purpose of resinous trees, and more particularly of pines, that we must operate to restore our forests. But it is at this point especially that a knowledge of the different species of pines, and of their principal varieties, becomes important; we may, indeed, according as we employ one or other of these, create on the same soil forests of the poorest or of the greatest value.

"This holds true especially of the *Pinus Silvestris*.

"In the greater part of the woods of resinous trees formed on a

pretty large scale in Maine, in some parts of Brittany, and more recently in Sologne, it is to the *Pinus Maritima* that a preference has been given, because its growth is rapid, successful culture is easily ensured, and the seed is abundant and cheap; but as is known to all foresters the *Pinus Silvestris* is capable of furnishing products infinitely superior in quality, in dimensions, and in value to those which can be obtained from the *Pinus Maritima*. And in connection with this subject there is a question which it is very important should be resolved, it is that relating to the relation of the Riga pine and the varieties of the *Pinus Silvestris*. The comparative culture, on the same land, of trees, of which it is desired to determine the identity or the difference, is what I have undertaken and carried into execution, as may be seen by statistical details relative to these species.

"I have brought together, in clumps more or less extensive, according to their importance, the *Pinus Silvestris* of every variety indicated by authors, and all those which, by whatever name known, it appeared to me might prove useful in this collection. In regard to the Riga pine, I have not been confined to a solitary lot, independent of seeds which I procured from the north, from sources the most certain: wherever I had knowledge of old plantations in France, known or presumed to have had the same origin, I have managed to obtain seeds or plants which, added to the lots introduced, directly furnished the means of studying further the question.

"These plantations have had for their special object the solution of numerous questions of botany and of forest economy, of which some are of great importance to France.

"Commenced thirty years ago, and with this view, and augmented every year since, they form now perhaps one of the most interesting and most useful collections of this kind in any country. They comprise, amongst other species, an assemblage of more than thirty lots of the *Pinus Silvestris*, obtained from as many different quarters and sources, for the study of the varieties of the species, and more particularly of the mast pines, or Riga pine, of absolutely certain origin, planted to admit of comparison with other varieties of the *Pinus Silvestris*, by means of which might be cleared away the doubts which have hitherto existed in regard to this tree, so important for naval architecture; an *école* of *Pinus Mugho*, *Pinus Pumilio*, and *Pinus Uncinata*, a necessary complement to the other in view of forest study; all the pines of the series of the *Laricios*, trees of great interest in sylviculture, but trees in regard to which

there exists at this time in books great confusion. The clumps of this series constitute one of the most beautiful portions of the plantations at Barres; one variety hitherto little known, the Laricio of Calabria, commands attention by its great vigour and beauty, as does also the Pine of the Pyrenees, a very beautiful tree of recent introduction; a plantation of Cedar of Lebanon, growing rustically among the pines, is thriving well; a collection of the forest oaks of South America, amongst which the most important, such as the Quercitron, the Red Oak, &c., have established themselves in massive plots; plantations of American Nuts, of *Bouleau à Canot*, of the *Alnus Cordifolia*, and of other exotic trees, the qualities of which and their vegetation on the soil of France cannot yet be known, from the limited numbers under cultivation; plantations of various oaks, particularly schools of oaks of Europe and of Asia, amongst which are worthy of note, *Quercus Fastigiata, Cerris, Tauzi, Aegilops* or *Velani*, in the avenues and borders; some new and remarkable poplars, &c.

"These plantations, if not complete, at least very extensive, will furnish to the man of science and to the practical man great means of study. The opinion, on this subject, of foresters and of distinguished agrinomes who have visited them have almost made it obligatory to publish the results I have obtained; and, having to some extent anticipated this, I fulfil the duty now with the more satisfaction, seeing that my conviction has always been in accordance with that which has been expressed to me. To make plantations of this sort fulfil the design of them, or to have the chance of doing so, supposing they should exist their full terms, it is necessary that the lots of which they are composed should be found with ease and with certainty when those who have created them shall be no more: for this every necessary arrangement has been made."

As has been stated, that one principal object aimed at by M. Vilmorin in the establishment of this Experimental Forest was to determine the varieties of the *Pinus Silvestris* and the properties of each, with their adaptation for culture in different districts of France; but other trees received also a large share of his attention.

I had the privilege of visiting the plantation and seeing it under the guidance of M. Henri Vilmorin, grandson of the founder, the honoured representative of three successive generations of noble-minded men, who distinguished themselves in this field of labour.

Of the Scotch Fir *(Pinus Sylvestris)* there were rows of trees, raised

from seed or seedlings received from different parts of the Continent and from Scotland, representing thirty varieties or sub-varieties of the tree; and rows of other coniferae, representing the products of nearly a hundred different parcels of seeds or seedlings received from various parts of the world; rows of oaks, representing the products of upwards of sixty different parcels of acorns and seedlings collected from all quarters; and rows, or one or more single trees, representing upwards of a hundred and fifty other hard-wood trees. There were in all some two hundred and twenty-five different species and varieties of trees, and numerous specimens of some of these, selected, some for their worth, some for their renown, and some for purposes of comparison and experiment; and they were planted alone or in clumps as might be necessary to bring out their characteristic points.

Since the death of M. Vilmorin, the founder, the portion of his estate containing the experimental forest has been purchased by the Government, that it may be maintained as a national establishment.

In Italy, shortly after the establishment of the present Kingdom, a Central Forest School was organised in the vicinity of Florence. The Director is M. di Bérenger, who was formerly in the Austrian forest service of Venezir, and is well known by an excellent work on the history of forest management in Italy (" *Archeologia Forestale, ossia dell' antica Storia e Giurisprudenza Forestale in Italia.*" Venezia, 1863.) The district assigned to the institution is the splendid silver fir forest of Vallombrosa, below the crest of the Apennines, on their western slope, about twenty miles east of Florence. During winter the school is transferred to a lower situation at Paterno, in the region of the Olive, half-way between Vallombrosa and the railway station of Pontassieve, in the valley of the Arno. For the use of the students a collection of excellent memoirs is being published by the director, with the assistance of some of the professors, the first volume of which has just been completed, containing an introduction on the climatic and general influence of forests; a brief historical account of forest management in Germany, France, and Italy; two memoirs on the structure, nutrition, and cultivation of forest trees; and a paper on the valuation of forests and the preparation of working plans.

I do not happen to possess any information in regard to the Forest School in Spain beyond the fact that there is such an institution; it is in the Escurial.

Having shown what are some of the provisions made for the study of Forestry on the Continent of Europe, I would next show what are the requisites for employment in the Forest Service of India.

Under date of July, 1872, were published the following particulars respecting the selection of candidates for nomination to junior appointments in November, 1872, in the Forest Department in India: —"An Examination will be holden on the 18th day of November, 1872, and following days, to select five young men, *if so many are found duly qualified*, to be trained in France and Germany for the Forest Service of India.

"Applicants must be natural born British subjects, above 17 and under 23 years of age on the 18th of November, 1872. They must be unmarried, and if they marry before they leave this country for India, they will forfeit their appointment as Junior Assistants.

"They must send to the Revenue Department of the India Office, on or before the 14th of October next,—

"1. Their names and parentage, a certificate, or other satisfactory evidence, of their birth, and, if under age, a statement of consent from parents or guardians.

"2. A statement of the places of education at which they may have been since they were nine years old, accompanied by testimonials of good conduct during the last two years, and proof of their having attained a certain standard of proficiency in the following branches of knowledge:—(1) English writing from dictation, and English composition. (2) Arithmetic in all its branches. (3) Algebra, elementary principles, simple and quadratic equations, ratios and proportions, logarithms, arithmetical and geometrical progression. (4) Geometery (1st, 2d, 3d, 4th, and 6th book of Euclid) and Plane Trigonometry. (5) Free hand-drawing. (6) A good colloquial knowledge of French or German, with the facility of translating from one of these languages.

"A preference will be given to those candidates who, in addition to the above, show proficiency in—Surveying and Land Measuring; and in the elements of Mechanical and Natural Philosophy, Chemistry, Botany, Geology, and Mineralogy, and in Plan Drawing.

"They must appear personally at the India Office on the 18th or 19th of November next, between the hours of 11 and 4.

"As active habits and a strong constitution are most important, such applicants as are admitted to be candidates will be directed to appear for medical examination before the Indian Medical Board.

"Those who are passed by the Board will be examined on the 21st

and following days in the various branches of knowledge mentioned above, by the Civil Service Commissioners.

"The regulations above stated *are liable to alteration in future years*; but no candidate, in this year, or hereafter, will be chosen *who does not come up to the requisite standard of proficiency in each of the prescribed subjects.*

"From among the candidates who attain this standard, Her Majesty's Secretary of State for India will select those whom he deems best adapted to the Service.

"The rules and conditions under which candidates for the Forest Service in India will in future years be selected will be notified hereafter.

"The candidates accepted by the Secretary of State must undergo a regular course of training of two years and a half in the management of forest and the science of Forestry, in surveying, road making, and the natural sciences. For this purpose, those candidates who possess a sufficient knowledge of German will be directed to proceed to Germany; while, for those who pass in the French language, the course of training will be in France, if the state of affairs in that country admits of their being sent thither. Until such time, they are to understand that their appointments may be kept in abeyance, or that they must subject themselves to such other training in this country or elsewhere, as the Secretary of State may direct.

"The course of training will commence on the 1st of March, 1873, and end in the autumn of 1875.

"During the course of training the candidates will be expected to conduct themselves throughout in a proper and gentlemanlike manner, to obey the injunctions of the officers and professors appointed to instruct them, to use due diligence in the practical work and in their studies, and zealously to improve every opportunity for learning that may be offered them. Candidates who do not conduct themselves in a proper and gentlemanlike manner, or do not show satisfactory progress in their studies, will be removed from the list of candidates on the report of the officer intrusted with the general direction of their studies.

"After completing the course prescribed, an examination will be held by the officers and professors intrusted with the instruction of the candidates. Those who give proof of a satisfactory progress in the subjects in which they have been instructed will be nominated Junior Assistants in the Forest Departments in India.

"According to the estimates framed, the cost of this training will

not exceed £500. This sum will, it is believed, cover the cost of board, lodging, and instruction for the whole term of two years and a half.

"To those candidates whose conduct and progress are satisfactory, Her Majesty's Secretary of State engages to pay a stipend at the rate of £50 for each half year. This stipend will ordinarily be paid half-yearly, on the recommendation of the officer intrusted with the general direction of the studies and training of the candidates; but the periods of payment may vary according to circumstances. In the case of those training in France, the first payment is usually made after eight, instead of after six months. One half of the stipend, or £25 for each half year, will be retained for payment of the fees and remuneration to the appointed Instructors.

"In the interval between the conclusion of the course of instruction on the Continent and the departure for India, the candidates will be required, if they have not had the opportunity of doing so before, to pass some time, probably not less than a month, with one or more approved foresters in Scotland.

"Within a month of his nomination as Junior Assistant, each nominee must sign a covenant, in the form appended hereto, describing the terms and conditions of his appointment; and he must embark for India when required to do so by the Secretary of State, who will provide for the expenses of his passage. Any nominee not embarking when required will forfeit his appointment. Otherwise he will be allowed pay at the rate of 250 rupees (which is about the equivalent of £25 in English money) a month, from the date of his signing the covenant.

"On arrival in India, the nominee will be required to report himself to the Government of India (or to the Government of Bombay or Madras, in case he should be sent to one of these Presidencies), and he will then be posted to such part of the forests as the service may require.

"The salaries of the appointments in the three Presidencies range between £300 and £1,900 a year. Promotion to them will depend upon efficiency, and the occurrence of vacancies.

"On reaching the place to which he may be appointed, the nominee will become entitled to all the rights and privileges, in respect of pay and promotion, accorded to officers of the Forest Department by the rules and regulations for the time being, and to leave of absence and retiring pensions under the leave and pension rules of the Uncovenanted Service for the time being. No rise of

pay or promotion will, however, take place before he has passed an examination in such one of the Native Languages as may be prescribed by the Government under which he is serving.

"There will be another examination for five candidates in November, 1873, when the present system of training for the Forest Department in India will come to an end."

In the statement issued in 1867 it was prescibed:—"Those of the candidates who will be selected by Her Majesty's Secretary of State for India must agree to undergo a regular course of studies and training of three years and a half in the natural sciences, in the practice and science of forestry, and in those branches of surveying and engineering required for the profession of a forest officer in India. The first, or purely scientific part of this course of training, will take place in Great Britain; for the second part, comprising the instruction in forestry and the subjects immediately connected therewith, arrangements will, for the present (until an efficient forest school in Great Britain or in India shall have been established), be made on the continent, that is, in France for those candidates who are sufficiently acquainted with French, and in Germany for those who are familiar with the language of that country. One year and a half is assigned to the first or purely scientific part, and two years to the training in forestry and the subjects intimately connected therewith. The following are the arrangements to be followed by candidates, but Her Majesty's Secretary of State reserves to himself the right from time to time to make such alterations in the course of studies and training as may be expedient.

"The studies of candidates during the first or scientific part of their training shall comprise the following subjects:—

"I. Mechanical and Natural Philosophy.—The elements of mechanics, hydrostatics, hydraulics, optics, heat, climate, rainfall, and the first elements of electricity and magnetism.

"II. Chemistry. Inorganic.—The non-metallic elements and the principal metals. Organic.—Elements only, with special reference to the chief constituents of the vegetable and animal organism, the chemical principles of the process of nutrition and of respiration in plants and animals. Fermentation, decay, putrefaction, destructive distillation.

"III. Botany.—Characters of the principal European natural orders. Ability to describe any common phaenogamous plant of ordinary structure, systematically and with accuracy, from a

living specimen. The elementary facts referring to the development and nutrition of plants.

"IV. Geology.—Elementary portions of descriptive geology.

"V. Either the French or the German Language.—Good colloquial knowledge, with the facility to read and translate into English easy passages taken from the works of some classical writer.

"Candidates are at liberty to choose the place of study, but they must, before being admitted to the second or practical part of instruction, pass an examination before the Civil Service Commissioners in the branches of science and in one of the languages enumerated above. This examination will be held in July or August, 1869, and the candidates must, on the day previous to the examination, report themselves at India Office, and produce testimonials from the professors or masters under whom they have been studying.

"Candidates who fail to pass the examination in sciences and one of the languages at the close of the first year and a half may continue their studies for another year, but they will not be allowed to present themselves more than twice for this examination.

"Those candidates who fail to satisfy Her Majesty's Secretary of State that they have attained a sufficient proficiency in the subjects mentioned will be removed from the list of candidates.

"Those candidates who, from previous study, feel themselves competent to pass the second or science examination at the same time as the first, or examination for admission, will be permitted to do so. Application for doing so should be made by them when sending in their papers and testimonials.

"Candidates who have taken academical degrees or honours in science and mathematics will, wholly or partially, be excused from the examination of admission, as well as the examination in sciences, and only be required to furnish proof of a sufficient knowledge of German or French. Candidates who have passed any examination requiring a sufficiently high standard of proficiency will be excused examination in those branches in which they have been previously examined. Her Majesty's Secretary of State for India will determine how far the certificates of candidates may entitle them to exemption, either entire or partial, from examination.

"It is very desirable that candidates should, before proceeding to the Continent for their professional training, devote two months to a practical apprenticeship with an approved wood manager or forester in Scotland. Early spring is the best season of the year for this

purpose. A certificate of their having done so will entitle them to a stipend of £20, to be paid in case they pass the science examination.

"The course of training in forestry abroad will commence on the 1st September, 1869, and be concluded on 1st September, 1871.

"The following arrangements have been made for those candidates who are qualified in French. They will proceed to Paris and report themselves at the "Direction Générale des Forêts." The months of September and October will be spent in a forest district for preliminary practical training. By the 1st November they will proceed to Nancy, where they will be received as students at the Imperial Forest School, and pass through the regular biennial course of studies, practical exercises, and periodical examinations with the French students. The whole expense of their residence in France has been estimated at 300 francs per month, or £144 per annum. The instruction is gratuitous.

"No entrance fees are paid at the schools. A small remuneration may have to be paid in addition to the above sum for the preliminary practical training.

"Those candidates who possess a sufficient knowledge of German will proceed to Hanover and report themselves to Mr Burckhard, the director of forests in the former kingdom of Hanover, who will undertake the general direction of their studies and practical training.

"During the first year the candidates will be placed with an executive forest officer in charge of forest district (Oberforster), where they will serve their apprenticeship in the practical work of a forester, and at the same time receive instruction in the science of forestry. The director will from time to time see them, and they will occasionally accompany him on his tours of inspection.

"During the second year the candidates will live at Hanover, where they will continue their studies in the different branches of the science of forestry, as well as in surveying and engineering, in so far as may appear requisite for a forest officer in India.

"They will occasionally accompany the director, or others of the principal forest officers, on their journeys of inspection, and will from time to time be sent to different forest districts, to become acquainted with the different kinds of forests, and the various methods adopted for their management. Should such hereafter appear expedient, the time assigned to Hanover may be spent at a forest school, as may be arranged by the director.

"The whole cost for maintenance and instruction during their

studies in Germany has been estimated at 100 thalers per month, or £180 per annum. This includes all remuneration paid for instruction."

In a communication made to the Under Secretary of State by Dr Brandis, Inspector-General of Forests in India, under date of London, 13th January, 1867, when the arrangements referred to were under consideration, it is stated amongst other things :—"There would not be any reason for considering any alteration of this plan, had it not been publicly attacked in strong terms. The principal attack has been made by Professor Balfour, of the Edinburgh University, Director of the Royal Botanic Gardens. He communicated his remarks at a meeting of the Botanical Society of Edinburgh, on the 13th of December, and they were reprinted in the *Farmer* of the 26th December, 1866. They are as follows:—

"'*Managers for Indian Forests.*—Dr Balfour laid before the Society a document which had been sent from the India House, relative to the preparation of young men for the Forest Department in India. Dr Balfour considered that it was most important to train up young men for this Department, but he saw no reason why they should be compelled to study forestry in Germany and France, and not be allowed to prosecute their studies in this country. He was satisfied that ample opportunities were presented in Britain for the acquisition of knowledge in all departments of science requisite for forest work, as well as in practical operations. There are many excellent foresters in Britain, who would train young men, and there are excellent nurseries in which the treatment of cinchona could be well studied. He hoped that the Secretary of State for India would see the propriety of not confining the studies to Germany and France, to the exclusion of Britain. Let young men study where they choose, but let them be carefully examined as to their scientific knowledge and their practical information. If the examination was conducted in a garden, means would be at hand for carrying it on in such a way as at once to bring out the capabilities of the candidates. By leaving the place of study open to candidates, the Government would also be saved expense in the matter. Any who choose to study on the Continent might go there. The German and French languages are not absolutely essential for the Indian Forest Department. It would be better that the candidate should be instructed in Hindustani, or in some of the Indian dialects, and this could be well done in any seat of learning in Britain. Botany, chemistry, natural history,

along with practical work in a botanical garden or nursery, could be well prosecuted in Britain.'

"The most important sentence in these remarks is that in which Professor Balfour declares himself 'satisfied that ample opportunities were presented in Britain for the acquisition of knowledge in all departments of science requisite for forest work, as well as in practical operations.'

"If this passage is intended to refer to mathematics, the natural sciences, surveying, it undoubtedly is correct. For the study of these sciences it would be neither necessary nor desirable to seek for opportunities outside of Great Britain.

"These, however, are the auxiliary sciences only. The main subject of study in the forest schools of France and Germany is the science and practice of forestry, viz., the culture, management, and working of the forests, and all that is connected with the administration of forests and forest legislation.

"I believe I am correct in stating that, for the study of these subjects, sufficient opportunities are not presented in Great Britain, whereas the opportunities afforded in the State forests, at the public forest schools, or by private tuition under eminent forest officers, in Germany or France, are excellent.

"I spent a considerable time, last year and the year before last, in examining a large number of woodlands and plantations in England and Scotland, and have become personally acquainted with a large number of foresters. I have also visited some of the Crown forests in England, and I desire here to state that I have seen many plantations of high timber forest, as well as of coppice wood, which had been established with great skill and success, and were under excellent management.

"But upon the whole the woodlands in Great Britain are on a much smaller scale than either in France or Germany, and, consequently, the management and administration of forests on a large scale is not so fully developed here as on the Continent, where forestry is recognised as one of the scientific professions, the principles and rules of which are based upon the most careful researches, and are illustrated and explained in a large number of scientific works, which form a large branch of the professional literature of those countries. I may add that, in German and French, there are no less than eight important monthly papers which are exclusively devoted to forestry, not counting a number of smaller periodical publications of the same character.

"The State forests of France alone cover an area of 2,706,000 acres, with a gross revenue of £1,740,600, upon which the charges amount to £494,320; those of Bavaria cover 1,962,000 acres, and those of Prussia, before the late war, 5,075,000 acres.

"Again, there are important differences in the general system of management, and upon the whole it may be said that the system which should be followed in many provinces of India approaches more the method which has gradually developed itself in Germany and France, and which in those countries has been brought to a high state of perfection. Without entering into details, which could not be exhausted in this paper, I may state, that on the Continent of Europe natural reproduction of the forest is the rule, not of coppice woods only, but also of high timber forest. The main point looked to in the management of a high timber forest in those countries is so to arrange the cutting and felling as to secure the ground being covered with a crop of self-sown trees before the old crop is entirely removed. This requires a careful and methodical management. In Scotland and England, with the exception of coppice woods and a limited extent of natural forest of Scotch fir in the Highlands, the system generally followed is to cut down the mature crops and to plant.

"In a large portion of the Indian forests natural reproduction will have to be relied upon for the maintenance of the forest, planting operations being carried on, as in France and Germany, where the old forest has disappeared, or has been injured so as to give us no hope of a satisfactory natural reproduction. Under similar circumstances, and on barren wastes, planting operations are carried on in Germany and France with great skill and success on a very large scale, and with great economy.

"Upon the whole, an intimate acquaintance with the system and practice of forestry in Germany and France is, in my opinion, a matter of the first importance for the successful management of a large portion of the Forests in India.

"Professor Balfour seems to labour under a misapprehension when, in the concluding sentence of his remarks, he sums up the subjects of education, and states that botany, chemistry, natural history, along with practical work in a botanic garden or nursery, could be well prosecuted in Britain. This, I beg to submit, would be an excellent education for a scientific gardener, but not for a forest officer. Nor could the examination be conducted in a garden, for the treatment of single plants in a garden and the management of woodlands or forests are two things essentially different.

"On the other hand, his statement that the German and French languages are not absolutely essential for the Indian Forest Department is perfectly correct. They are merely required as a bridge to enable candidates to acquire that knowledge and practical experience which they cannot otherwise obtain."

The remarks made by Dr Brandes in regard to the requirements of forest conservation and extension in India are more or less applicable to the requirements of forest conservation and extension in some of the British Colonies, and, I may add, in some of the States in America; but without entering on the alleged requirements of India, I consider, from what I do know, that the requirements of forest economy in many of our colonies might be met, in accordance with the reported views of Dr Balfour; and great advantage to intelligent foresters who wish to give themselves to the management of forests in Britain, to the proprietors of such forests, and, through them, to the country at large, might be secured by the establishment of a lectureship on Forest Science in connection with the Edinburgh Arboretum.

Dr James Brown, in his treatise on Forestry,* laments that there is not a school in Great Britain where young men can learn efficiently all the branches of study in connection with forestry, and gives the following advice as to the way in which a self supporting institution for that purpose might be established: "Let an arboricultural association be formed of some of the leading landed proprietors in the country, with a few men of science among them, having for their object the cultivation of trees on the most approved and improved principles of the age, and the training up of young men as foresters according to these principles, in order to fill the places of the existing foresters of the old school, and thus as early as possible bring about an improved state of arboriculture for the general welfare of the country.

"Then, supposing that such an association were formed, Where and How is the field of their operations to be had? Of course, they could not undertake anything in a definite and practical way in respect to forestry without this. Such a field may easily be had, as there are many landed proprietors in this country who have more estates than one, and who would be willing, I have no doubt, to give over the woodlands on one of them for the purpose of forming an arbori-

* "Forestry; or, A practical treatise on the planting, rearing, and general management of forest trees." Fourth edition. William Blackwood and Sons, Edinburgh and London. 1871.

cultural school of it, of course under safe and proper conditions to both parties. The outline of the conditions might be made somewhat as follows: The proprietor, R. F., lets to the association———, for a period of, say forty years from date, all the woodlands at present on the estate of A., extending to about 2,000 acres, as per plan of the property to be referred to, at an annual rent of £——. The several crops embraced to be thinned, and otherwise dealt with for their improvement in health and value by the said association, and according to a mode to be proposed by them and approved of by the said R. F., the proprietor, who is to sell the timber and other produce for his own behoof, the association to be paid by him for the labour performed by them in dealing with the works of thinning and otherwise improving the crops, as may be agreed upon, all at the usual rates for such works; these to be agreed on between the association and the said proprietor's agent at the beginning of each year, and before the works commence for the season. And the said R. F., the proprietor, lets also to the said association, for the said period of forty years, for the purpose of being planted by them from time to time with suitable kinds of trees, as may be agreed on between the parties, that piece of waste land known as ——, and extending to 1,800 acres, at the annual rent of £——. This portion of land is let to the association on the understanding that, at the end of their lease, the said R. F., the proprietor, shall take over all the crops that shall then be found growing on it, at a valuation to be settled by two neutral men of skill, mutually chosen, when the said R. F., or his heirs, will pay the association the full value that may then be made in respect to the crops of trees that may have been planted by them on said land. And it is to be understood that during the currency of the lease the said association shall have full power to manage the woods they may plant on said waste land in their own way and as they may think fit, and to use for their own behoof all proceeds arising from them; it being understood, however, that all the crops they may plant shall be properly treated and trained, so as to insure their being valuable to the estate as a crop on the land, when they are handed over to the proprietor of the land at the end of the lease. And it is also agreed that the said association shall have no power to clear any portion of said crops of trees they may plant, or any portion of any crops whatever, without the consent of the proprietor of the land. . . . .

"A president and vice-presidents, with directors, would have to be appointed, as also a secretary, a treasurer, and auditor. Next, the working-resident staff might be a manager, who would be accountable

to the president and directors for the proper working of the objects of the association. He would be assisted by a professor of botany and vegetable physiology, and one of geology and chemistry, the latter combining physical geography and climatic science; while he, the manager, would also have the assistance of a first-class practical forester, whose duties would be to carry out all the practical operations, under the directions of the manager, in dealing with the woods, and at the same time instruct and guide the pupils while at their various works in the woods.

"To accommodate a staff of this kind, together with, say fifty or sixty pupils, a convenient house would require to be provided, and as to whether the pupils would be resident in it or not, would of course depend on a careful consideration of all the circumstances in connection with the locality in which the field was situated. At all events, one-half of the pupils would require to attend at a given hour every morning, to hear lectures and other instructions on the subjects to be taught by the professors, while the other half would go out to work in the woods. These would return in the afternoon to get their course of instructions, while those who were studying in the morning would go out and take their places in the woods; and in this way the routine of daily theoretical and practical instructions would be carried on. Of course a portion of the waste land would be taken up for planting every year, in order to have the young men trained to the proper way of doing it, as also thinning in the different plantations, with bark-stripping, pruning where necessary, draining, etc. In short, all these branches of work would be undertaken every year on some portion of the crops; and as all the works would be performed by the pupils themselves, under the direction of the forester, every one would have the full opportunity of gaining practical experience, as well as theoretical knowledge, on the various branches of forestry. And it would be necesary to keep all the woods under the management of the association in the very best possible condition, so that their character might become a model for all others to imitate. And, besides, it would be desirable for the manager and his professors to visit, from time to time, the woods on other properties, and take with them their pupils to see them, when they would have an opportunity of comparing the management of other woods with that of those on their home district; and in this way the pupils would get much useful information and experience, within the shortest possible time, under the guidance of their teachers, and thus render them more intelligent and experienced than they would be were their observations confined to the woods on the home field alone. . . .

"In dealing with the pupils, the amount of fees they would pay would, of course, depend upon whether they were lodged in the institution or not, and had bed and board provided for them. I should say that they should be resident in the institution, and all receive like treatment as to education, board, and lodging. If they were not resident lodgers, irregularity would be certain to ensue, and want of proper rule. Then, if lodged, £50 a year might be a fair charge for each pupil. At all events, it should not exceed this sum. In accounting with the pupils, they ought to have put to their credit and deducted from their fees at the end of each term, when settlement is made, the value of the work they perform in the woods, at a fixed rate per hour or per day, as may be arranged. This would make them more industrious than they otherwise would be, and make them take good interest in the works they were engaged in. This value of work would, of course, be refunded to the association by their account against the proprietor of the woods for the work performed in them by their pupils.

"In order that the pupils might be properly instructed in all the branches bearing on arboriculture, and to secure the professors and all concerned doing their duties, an examination of the progress made by the pupils should be made by the president and directors at the end of every six months, and awards put to the credit of the most proficient and deserving. . . .

"As the young men become proficient in all the branches (after three years' residence at the institution), theoretical and practical, of forestry, and leave the institution, they should have each his certificate or diploma, stating his general acquirements and abilities, and whether he is *first*, *second*, or *third* class in his profession. These certificates should of course, be given by the president and directors, and signed also by the professors; and they should form a guarantee to landed proprietors who might be in want of foresters that the holders are men of undoubted professional abilities, and worthy of being trusted with the management of their woods."

This project I submit for consideration along with that which I have proposed.

I have been asked—How has it come to pass that so little has been done in Britain, while so much has been done on the Continent of Europe to raise up a body of foresters, highly educated for the discharge of their duties? My answer must be—Hitherto the problem to be solved in Britain did not require the amount of information

which was required for the solution of the complicated problems demanding solution there. On the Continent they were threatened in many quarters with a lack of fuel, with a lack of timber, with ruinous desiccation, and with destructive torrents, all consequent on the destruction of their forests, and with the devastation of fertile lands by drift sands, which could only be arrested and utilised by the planting of trees. In Britain we find fuel in our coal mines, and in many country districts in our peat bogs; excepting for a short time about the beginning of the present century, when war was raging, we could get timber of every description from beyond the sea; we know little of drought, of torrents, and of drift sands, and the difference has even told upon our language. While our French neighbours speak of *Sylviculture*, the culture of woods, we speak of *Arboriculture*, the culture of trees. While they, in speaking of *La Forêts* and of *La Code Forestière*, refer to a country covered more or less with trees, we, in speaking of *The green wood* and of *Forestry*, hitherto have thought chiefly of the game and of the chase, or of the shooting of deer. Our forest laws relate mainly, if I may not say exclusively, to hunting, these laws having nothing to do with shrubs and trees, excepting in so far as they may supply shelter or covert for game. I speak advisedly when I say, that, according to the technical use of the term in English law, a forest need not contain a single tree, and a dozen of contiguous counties might be covered with trees without these constituting a forest. The totally different circumstances in which the different countries have stood in regard to the requirements of forest products account for the difference in the attention hitherto given on the Continent and in Britain to the study of what is known there as Forest Science.

It may be asked, seeing it is so—Why should we not go on as we have been doing hitherto? The answer is given in the passage I have cited from Dr Hooker (*ante* p. 2). In our Colonies, and in the Indian Empire of India, evils which have existed long are being experienced and remedied; and those whom the country would engage to go forth to meet the evils must go, at the country's expense, to acquire the necessary education in other lands, and in a foreign language, unknown to most young gardeners and foresters, and sons of foresters, whose life has been spent in connection with the management of trees, and which is so taught in many of our schools, that few even of the young men of our country who have had a liberal education could understand instruction given in it as they could instruction given in their own tongue.

In illustration of the difference in the amount of literature existing in our language and in the language of Continental Europe, and as indicative of the magnitude of the change which is passing over different lands in which the English language is the language of the people, I may be allowed to make the following statement, though in its commencement personal to myself:

I went to the Cape of Good Hope to act as Colonial Botanist in the beginning of 1863. On my arrival I was officially informed that the office had been created some five years before with the two-fold object (1) of ascertaining and making generally known the economic resources of the Colony, as regards its indigenous vegetable productions, and its fitness for the growth of valuable exotic trees and other plants; and (2) of perfecting our knowledge of the flora of South Africa, and thus contributing to the advancement of botanical science.

On making my first tour of the Colony to see its flora and its capabilities, I found myself face to face with a difficulty in the way of the developement of these capabilities, arising from a reckless destruction of forests and of forest products which was going on, and a progressive desiccation of the climate, accompanying or following the destruction of forests and the burning of herbage and bush in connection with agricultural operations and pastoral husbandry. And I knew not then, nor do I know now, of a single work published in England from which I could then procure information in regard to the treatment required by aboriginal forests, to secure their conservation and improvement, excepting "The Forests and Gardens of South India," by Dr Cleghorn, then Conservator of Forests in the Madras Presidency; "The Forester," by Dr James Brown; "The *Arboretum et Fruticetum Britannicum*," by Louden; and "English Forests and Forest Trees," an anonymous work published by Ingram, Cooke, and Co., London. But none of these supplied the information I required.

Contrast with this the richness of continental languages in literature on such subjects. I have had sent to me lately "*Ofversight af Svenska Skogsliteraturen, Bibliografiska Studieren af Axel Cnattingius*," a list of books and papers on Forest Science published in Sweden; I have also had sent to me a work by Don José Jordana y Morera, Ingenero de Montes, under the title of "*Apuntes Bibliographic Forestale*," a *catalogue raissoné* of 1126 printed books, MSS, etc., in Spanish, on subjects connected with Forest Science.

I am at present preparing for the press a report on measures

adopted in France, Germany, Hungary, and elsewhere, to arrest and utilise drift-sand by planting them with grasses and trees; and in *Der Europaeische Flug-sand und Seine Kultur, von Josef Wessely General-Domaenen-Inspektor, und Forst-Academie-Direktor*, published in Vienna in 1873, I find a list of upwards of 100 books and papers on that one department of the subject, of which 30, in Hungarian, Latin, and German, were published in Hungary alone.

According to the statement of one gentleman, to whom application was made by a representation of the Government at the Cape for information in regard to what suitable works on Forest Economy could be procured from Germany, the works on *Forst-Wisserchaft*, Forest Science, and *Forst-Wirthschaft*, Forest Economy, in the German language may be reckoned by cartloads. From what I know of the abundance of works in German, on subjects connected with Forestry, I am not surprised that such a report should have been given. And with the works in German may be reckoned the works in French.

In Hermann Schmidt's *Fach Katalogue*, published in Prague last year (1876), there are given the titles, etc., of German works in *Forst- und Jagd-Literatur*, published from 1870 to 1875 inclusive, to the 31st of October of the latter year, amounting in all to 650, exclusive of others given in an appendix, containing a selection of the works published prior to 1870. They are classified thus :—General Forest Economy, 93; Forest Botany, 60; Forest History and Statistics, 50; Forest Legislation and Game Laws, 56; Forest Mathematics, 25; Forest Tables and Measurements, etc., 148; Forest Technology, 6; Forest Zoology, 19; Peat and Bog Treatment, 14; Forest Calendars, 6; Forest and Game Periodicals, 27; Forest Union and Year Books, 13; Game, 91; Forest and Game in Bohemian, 44. In all 652. Upwards of a hundred new works published annually. Amongst the works mentioned is a volume entitled *Die Literatur der letzten sieben Jahre* (1862-1872) *aus dem Gesammtgebiete der Land und Forst-wirthschaft mit Einschlusz der landw. Gewerbe u. der Jagd, in deutscher, französischer u. englisher sprache Herausg. v. d. Buchhandl. v.* Gerold and Co., *in Wien*, 1873, a valuable catalogue of 278 pages in large octavo.

Since the time which I have spoken of, fifteen years ago, a change has manifested itself in the different lands in which the English language is spoken. By an order of the House of Commons, dated 17th August, 1871, there was printed the "Return to an address of

the House, dated 15th May of the same year: a selection of dispatches and their enclosures to and from the Secretary of State for India in Council, on Forest Conservancy in India, showing the measures which have been adopted, and the measures which are going on, in the several presidencies and Lieut.-Governorships, beginning with the dispatch from the Governor-General in Council, of 21st day of May, 1862, to the present time." And the Return comprises two printed volumes, consisting of 1671 folio pages on India, one of 441 pages on Madras, and one of 357 pages on Bombay. In all 2469 pages folio. And they report an approved estimate of expenditure, for the year 1871-1872, on forests in the Indian Empire of 45,11,000 rupees, and an estimated income of 57,34,000 rupees; or according to another account an annual expenditure of upwards of £450,000, with annual returns of upwards of £570,000.

In 1871 a commission was appointed by the Government of Victoria to report amongst other things on the best means of promoting the culture, extension, and preservation of State Forests in Victoria, and the introduction of such foreign trees as may be suitable to the climate and useful for industrious purposes, which committee has gone to considerable expense and trouble in collecting and printing information from New Zealand, India, the United States, Hanover, Prussia, Saxony, Bavaria, Austria, Baden, Italy, and Sweden, as well as Great Britain, availing themselves largely of the published report by Captain Campbell Walker on State Forests and Forest management in Germany and Austria, which I have cited in speaking of the Forest Schools of Germany.

In the Report of the Commission of Agriculture, laid before the Senate and the House of Representatives of the United States, in 1865, there was embodied a Memoir on "American forests—their destruction and preservation," by Rev. Frederick Starr, of St Louis, Mississippi, of which Report 165,000 copies were ordered by the House of Representatives to be printed, and within a week, 20,000 "extra copies" were ordered by the Senate.

The subject has since then engaged the attention of the Government and the Legislatures of many of the States. In many of the States, trees are being planted by the million; in some, prizes are being offered for the most extensive plantations; in others, land is granted in freehold in consideration of definite portions being planted with trees; in not a few, a new annual holiday, designated Arborday, is appointed, and with merry-making and energy is devoted to the work; and both last year, and in this, since the excitement in

regard to the election of the President has subsided, the Central Government and Legislature at Washington have taken important further steps in advance in connection with this matter.

These facts may be accepted as indications that it is becoming of importance that arrangements should now be made for instruction in Forest Science being communicated in English to those to whom may be entrusted the administration and management of forests, but who can only imperfectly avail themselves of the extensive arrangements for this being done in the other languages of Europe.

But, again it may be asked—May not all that is required be supplied through the press? All the arrangements made for conducting the studies of young men in the College Faculties of Arts, Medicine, Theology, and Law, in the Universities of the country, may prepare us to anticipate an answer in the negative. The arrangements made by the Indian Department of the British Government for the education and instruction of those who are to be employed in the Forest Service of India seem also to say No. And I know that my own studies in Forest Science would have been greatly facilitated had I had access to a teacher.

Within the last six weeks one of the Honorary Members and Vice-Presidents of the Scottish Arboricultural Society, himself a forester, has written to me:—"I have perused carefully the printed paper you so kindly have sent me, and I am delighted to see your very judicious suggestion in regard to the teaching of Forest Science. It is a great want, and always has been a want in Great Britain.

"In Germany, appointments in the forests are esteemed equal to any of the learned professions. In Prussia, a few years ago, there were no fewer than thirty-three Baronets held appointments in the Crown Forests.

"In India the field of remuneration is from £300 to £1900 a-year.

"It is certainly a disgrace to Britain to be so deficient in having means of imparting instruction in the Science of Forestry at home, when we are obliged to send British subjects to Prussia and France to qualify them for the Indian forests.

"Every University in Great Britain should have a Professor bound to give instruction in the Science of Forestry.

"Every other branch of learning, such as engineering, geology, practical forestry, etc., etc., could be acquired by young forest officers in Great Britain as well as on the Continent of Europe."

Another Honorary Member and Vice-President of the Society

wrote to me :—"I quite agree with you in the importance of Forestry being taught as a science in this country. I even go further, and think the Government should have a *Forest School* in this country, similar to those at Hanover, Nancy, etc., etc., so that students for *Indian* Service could be educated here, instead of being sent to those parts abroad, where frequently the want of knowledge of the language is an obstacle to their acquiring much benefit."

And a Member of the Arboricultural Society has written to me :—"I think the idea of having the study of Forestry in connection with Botany, in any of our educational institutions, a good one, and most valuable ; and, wherever it is adopted, is certain to command success, and add to the prosperity of the institution which has the enterprise to go in for it. The Forest Science has not, so far as I am aware, been a branch of study in this country, so that consequently few know anything about it."

If my memory serves me right on the formation of the Scottish Arboricultural Society, more than twenty years ago, in the opening address by Dr James Brown, author of "The Forester," etc., and in an address by the late Mr Thomson, Deputy-Surveyor to H.M. Commissioners of Woods and Forests, prominence was given by both to the want which was felt of a School of Forestry ; and from letters which I have received from office-bearers and members of the Society, and from others, I learn that at present that want is felt by many.

This feeling I know is shared by some of the Governors of our Colonies. Sir H. Bartle E. Frere, Member of Council for India, and Governor at the Cape of Good Hope, writes :—"I strongly share your opinions, as far as I can gather them from the books and papers I have seen from your pen, relative to the great value to countries like India and South Africa of a scientific study of climatology and of arboriculture, as a means of obviating the desiccation of lands whose fertility has been impaired by the destruction of forests ; and what you have written and published seems to me a very valuable addition to the literature on the subject.* If a communication of these views

*"Hydrology of South Africa : or, Details of the former hydrographic condition of the Cape of Good Hope and of causes of its present aridity, with suggestions of appropriate remedies for this aridity." In which the desiccation of South Africa from pre-Adamic times to the present day is traced by indications supplied by geological formations, by the physical geography or general contour of the country, and by arborescent productions in the interior, with results confirmatory of the opinion that the appropriate remedies are irrigation, arboriculture, and an improved forest economy : or the erection of dams to prevent the escape of a portion of the rainfall to

can be any assistance to you, I shall be glad if you make use of this letter in any way you think proper."

Sir Rawson W. Rawson, late Governor of Bermuda, previously Governor of the Bahamas, and formerly Colonial Secretary at the Cape of Good Hope, writes :—"I have received your letter and its enclosures, and I thoroughly appreciate the importance of introducing into this country the study of Sylviculture upon a scientific basis, and of endeavouring to furnish a supply of teachers and practical men for the British Colonies. I wish you success in your attempt."

I have received similar expressions of the feelings of many landed proprietors, and others taking an interest in the woods and forests of Britain; and, since the preceding sheets were printed, I have received assurance of sympathy from collaborateurs on the Continent and in the United States.

The opinion which I have submitted for consideration in view of the proposed creation of an Arboretum in Edinburgh is, that with the existing arrangements for study in the University of Edinburgh and in the Watt Institution and School of Arts there are required

the sea; the abandonment or restriction of the burning of the herbage and bush in connection with pastoral and agricultural operations; the conservation and extension of existing forests; and the adoption of measures similar to the *réboisement* and *gazonnement* carried out in France with a view to prevent the formation of torrents and the destruction of property occasioned by them. London: Henry S. King and Co. 1875.

"*Réboisement* in France: or, Records of the re-planting of the Alps, the Cevennes, and the Pyrenees with trees, herbage, and bush, with a view to arresting and preventing the destructive consequences of torrents." In which is given a *resumé* of Surrell's study of Alpine torrents, and of the literature of France relative to Alpine torrents, and remedial measures which have been proposed for adoption to prevent the disastrous consequences following from them; translations of documents and enactments showing what legislative and executive measures have been taken by the Government of France in connection with *réboisement* as a remedial application against destructive torrents; and details in regard to the past, present, and prospective aspects of the work. London: Henry S. King and Co. 1876.

"Forests and Moisture; or, Effects of Forests on Humidity of Climate." In which are given details of phenomena of vegetation on which the meteorological effects of forests affecting the humidity of climate depend; of the effects of forests on the humidity of the atmosphere, on the humidity of the ground, on marshes, on the moisture of a wide expanse of country, on the local rainfall, and on rivers; and of the correspondence between the distribution of the rainfall and of forests; the measure of correspondence between the distribution of the rainfall and that of forests; the distribution of the rainfall dependent on geographical position determined by the contour of a country; the distribution of forests affected by the distribution of the rainfall; and the local effects of forests on the distribution of the rainfall within the forest district. Edinburgh: Oliver and Boyd. London: Simpkin, Marshall, and Co. 1877.

only facilities for the study of what is known on the Continent as Forest Science to enable these institutions conjointly, or any of them with the help of the others, to take a place amongst the most completely equipped schools of Forestry in Europe, and to undertake the training of foresters for the discharge of such duties as are now required of them in India, in our Colonies, and at home.

In connection with this opinion I have brought forward the comprehensive demands of the advanced Forest Science of the day, for which provision is made on the Continent of Europe, and in doing so I have supplied means of testing the correctness of my allegation.

I know that the opinion exists that everything combines to point out Edinburgh as the site most suitable for a Scottish School of Forestry, and I presume there can be but one opinion on the subject.

Adjoining the Arboretum are the Botanic Gardens and the Experimental Gardens. In the former is a large museum of vegetable products, and a large library of books on subjects connected with botany; and in the Arboretum is a mansion which might be utilised in various ways. In Edinburgh is a Standing Committee of the Highland and Agricultural Society, for granting certificates of attainments in the knowledge of forestry.*

* The following is an excerpt from a number of the Daily Review issued last month (29th March, 1877):—"*Highland and Agricultural Society—Agricultural Education.*—The annual examination of candidates for the diploma and certificates in agriculture, which the society is empowered to grant under its Supplementary Charter of 1856, was held in the society's chambers on Monday, Tuesday, and yesterday. The two first days were entirely devoted to written answers, and yesterday was occupied by the oral examinations which were open to the public. The subjects of examination and the several examiners were as follows:—*Science and Practice of Agriculture, Mechanics, and Construction*—Professor Wilson, and Messrs Mylne, Niddrie Mains; and Munro, Fairnington. *Botany*—Professor Balfour. *Chemistry*—Dr Andrew P. Aitken. *Natural Historg*—Professor Sir C. Wyville Thomson. *Veterinary Surgery*—Professor Williams. *Field Engineering and Surveying*—Mr David Stevenson, C.E. *Book-keeping and Accounts*—Mr Kenneth Mackenzie, C.A. Ten gentlemen presented themselves as candidates, and the examinations resulted in the following passing—*For Diploma.* . . *For First-Class Certificate.* . . *For Second-Class Certificate.* . ."

Similiar are the arrangements made for granting First and Second Class Certificates in Forestry. The board of examiners last year was composed of the following gentlemen, and it may be presumed that it is so still.

Examiners in the *Science of Forestry and Practical Management of Woods*, Dr Cleghorn, Stravithy, St Andrews; John M'Gregor, Ladywell, Dundee; William M'Corquodale, Scone Palace, Perth; J. Grant Thomson, Granton, Strathspey. *Elements of Botany*, Professor Balfour, Edinburgh. *Nature and Properties of Soils, Drainage and Effects of Climate*, Professor Wilson, Edinburgh. *In Land and Timber Measuring and Surveying; Mechanics and Constructions as applied to Fencing, Draining, Bridging, and Roadmaking; Implements of Forestry*, A. W. Belfrage, C. A., Edinburgh; *Book-keeping and Accounts*, Kenneth Mackenzie, C.A., Edinburgh.

Nowhere in the kingdom are there so many nurseries in one locality. These may at once supply students; opportunities to students to see nursery operations; and, it may be, employment to some young men of promise who may have to work for their support while pursuing their studies.

The laying out and the formation of the Arboretum may, for a time, give to students and intending students an opportunity of seeing arboricultural operations and of learning the reasons determining some of these. And the metropolis of Scotland is a central place, from which tours of observation may be commenced, be these to examine the plantations of the North of Scotland, the Crown Forests of England, or the Continental Forests of Northern or Central Europe.

Thus, with existing arrangements for the teaching of classes in the University and in the Watt Institution, all that seems to be lacking in addition to the Arboretum is a Lectureship or Professorship of Forestry, to combine the provision existing for the study of other branches of what is known on the Continent as Forest Science.

With students of Forestry in India, on the Continent, and in Britain, to draw upon for candidates, no difficulty need be anticipated in finding a teacher. In regard to funds required, the expenditure might be minimised by committing the curatorship of the Arboretum with an adequate salary to a man of science, as is done with the Royal Botanic Gardens, of which Dr Balfour is the Keeper, and the Royal Gardens at Kew, of which Dr Hooker is the Director, and combining with the curatorship of the Arboretum the lectureship in question. If from prudential consideration it were deemed expedient that the curatorship should be committed to a practical forester, who should be able personally to direct the execution of measures by him thought necessary, and be able to do so without responsibility to another, some other arrangement, entailing an increased expenditure, might be necessary; but the salary of a practical forester thus saved might go some way towards meeting this, or it might be otherwise provided for if the adoption of the measure be found to be desirable.

Should a lectureship on Forest Science be established in connection with the Edinburgh Arboretum, the students at which could avail themselves of existing arrangements in the University and in the Watt Institution for the study of related subjects, the proposal of Dr James Brown might then be carried out, relieved of the support of the Professors of Botany and Vegetable Physiology, and of Geology, Chemistry, Physical Geography, and Climatic Science, with which the scheme as then suggested by him was necessarily weighted.

In conclusion, I further submit for consideration, that if the views I have advanced commend themselves to the Lord Provost, the Magistrates, and the Councillors of Edinburgh, and they, in transferring to the Government the ground at Inverleith, were to accompany the deed with an expression of their views; if the views advanced commend themselves to the Office-bearers of the Arboricultural Society, and they were to communicate to the Government an expression of their views; and if the views advanced commend themselves to the Promoters of the purchase of the ground for the formation of an Arboretum, or to any others who may take an interest in the measure, and they conjointly or individually were to communicate to the Government an expression of their views, the Government might feel free to give to the subject a measure of consideration which the mention of it by a single individual might not seem to justify should it not appear at once to be an object of national importance.

I am,

GENTLEMEN,

Your obedient Servant,

JOHN C. BROWN, LL.D.

HADDINGTON, *12th April, 1877.*

KIRKCALDY: CRAWFORD AND WALKER, PRINTERS.

WORKS ON FOREST SCIENCE.

BY DR. BROWN.

"HYDROLOGY OF SOUTH AFRICA: or, Details of the former hydrographic condition of the Cape of Good Hope and of cau s of its present aridity, with suggestions of appropriate remedies for this aridity." In which the desiccation of South Africa from pre-Adamic times to the present day is traced by indications supplied by geological formations, by the physical geography or general contour of the country, and by arborescent productions in the interior, with results confirmatory of the opinion that the appropriate remedies are irrigation, arboriculture, and an improved forest economy: or the erection of dams to prevent the escape of a portion of the rainfall to the sea; the abandonment or restriction of the burning of the herbage and bush in connection with pastoral and agricultural operations; the conservation and extension of existing forests; and the adoption of measures similar to the *réboisement* and *gazonnement* carried out in France with a view to prevent the formation of torrents and the destruction of property occasioned by them. London: Henry S. King and Co. 1875.

"REBOISEMENT IN FRANCE: or, Records of the re-planting of the Alps, the Cevennes, and the Pyrenees with trees, herbage, and bush, with a view to arresting and preventing the destructive consequences of torrents." In which is given a *resumé* of Surrell's study of Alpine torrents, and of the literature of France relative to Alpine torrents, and remedial measures which have been proposed for adoption to prevent the disastrous consequences following from them; translations of documents and enactments showing what legislative and executive measures have been taken by the Government of France in connection with *réboisement* as a remedial application against destructive torrents; and details in regard to the past, present, and prospective aspects of the work. London: Henry S. King and Co. 1876.

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In the Press.

REPORT ON THE WATER SUPPLY OF SOUTH AFRICA: Its sources, its quantity, the modes of irrigation required in different circumstances, the facilities for the adoption of these in different districts, and the difficulties, physical and other, in the way of works of extensive irrigation being carried out at the Cape, and the means of accomplishing these which are at command.

Preparing for the Press.

DRIFTS: Report on the arrest of drift sands and the utilisation of sand plains by sylviculture in France, Belgium, Germany, Russia, Hungary, and other lands, with a view to showing the practicability of arresting and utilising drift-sands and sand-plains in South Africa.

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